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# AN EVALUATION OF ARCHAEOLOGICAL RESOURCES OF TULE, DUGWAY, FISH SPRINGS, WHIRLWIND AND SNAKE VALLEY CHARACTERIZATION SITES, MILLARD, JUAB, AND TOOELE COUNTIES, UTAH

Prepared for

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## CULTURAL RESOURCES REPORT

1. CR Report No:

2. Dates of field operations: June 28 - July 4, 1979.

3. Archaeologists: William H. Doelle and Linda L. Mayro, HDR Ecosciences, Santa Barbara, CA

4. Project: An archaeological survey of proposed geotechnical test sites in Tule, Dugway, Fish Springs, Hamlin, Whirlwind, and Snake Candidate Deployment Parcels conducted for FUGRO National, Inc.

5. District Office: BLM Richfield

6. State: Utah

7. Counties: Tooele, Juab, Millard

8. Legal description: Areas within T9-25S, R9-20W; see permit application submitted under separate cover by Fugro National, Inc.

9. Map reference: See attached maps at the end of this report.

10. Research objectives: In order to ensure that no impacts to archaeological sites would occur as a result of proposed Fugro geotechnical tests, each of the proposed activity areas was intensively surveyed for archaeological remains. When an archaeological site was encountered, the test site was moved to an area devoid of artifacts. In some cases, the archaeological remains were sufficiently outside the test areas so that it was not necessary to move the test site. As a result of this survey, no impacts to archaeological sites are anticipated.

11. Consultations:

National Register. To confirm the results of this survey, the National Register of Historic Places was consulted, specifically the Annual Listing of Historic Properties in the Federal Register (Feb. 6, 1979) and subsequent Federal Registers dated through July 3, 1979. As a result, it was found that there are no prehistoric or historic sites known to exist in the immediate project area which either appear on the National Register or are nominated for inclusion. There are sites on the Register in the general vicinity of the study area. These include archaeological site Utah 42 MD 300, the Topaz War Relocation site, Fort Deseret, and the Gunnison Massacre site in Millard County. In Juab and Tooele counties, there are no sites on the Register in the vicinity of the project area.

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Utah Division of State History. State site files were consulted for the locations of archaeological sites previously recorded in the area. Approximately 170 sites are known in the general area being considered. While none of the test sites appeared to conflict with the known archaeological sites, the locations of these sites were plotted on field maps to ensure avoidance of known archaeological sites and to avoid duplication of recording.

12. Existing Data Review: Site files current to January 1979 were obtained from the Utah Division of State History and provide a basis for assessing the present state of knowledge regarding the study region. To accomplish this the region is divided into six valleys that correspond closely, if not exactly, with the Fugro Candidate Deployment Parcels (Figure 1).

Previous survey projects have focused primarily on three different areas within the study region. Pendergast (1962) and Anderson (1962) both worked in the Fish Springs National Wildlife Refuge, which is unlike most of this region in that it is very well-watered. The sites discovered were mostly surface scatters of obsidian flakes with some sites containing fire-cracked rock and ground stone or a few pieces of pottery. Four cave sites in the Fish Springs Mountains were also documented. The second previously surveyed area is the Tule Valley, also known as White Valley. Berge (1964) found approximately 70 sites clustered around two springs in the center of the valley and within sand dunes along an ancient beach line on the eastern side of the valley. A series of projects have been conducted in the third area, the Deep Creek Mountains. Early archaeological research on the west side of these mountains was completed by Malouf, Dibble and Smith (1950), and an intensive sample survey (Lindsay and Sargent, 1977) and a program of test excavations (Sargent, 1978) were recently completed on the southeastern side of the Deep Creeks for the Bureau of Land Management. This work has documented the occurrence of archaeological remains in all but alpine environmental settings. These remains are affiliated with four major aboriginal cultural groups and date from as early as about 10,000 B.C. to as recent as the 19th century. In addition to the work in these three areas, some survey has been carried out by the Bureau of Land Management, private firms, and university researchers. All such work within the present study region has been very limited in scale. Furthermore, recording of prehistoric aboriginal sites has been emphasized, few historic sites are recorded in the site files.

Because the site file information available for this study varies in its completeness, the goal is to characterize the relationship between the known sample of archaeological sites with only two environmental variables. The first variable is proximity to a permanent water source. The location of present day water sources was established by examining U.S. Geological Survey maps and by examining site survey forms. Because the location of water sources can change through time, it is probable that many sites that were once near water are quite distant from a modern water source. This fact has probably

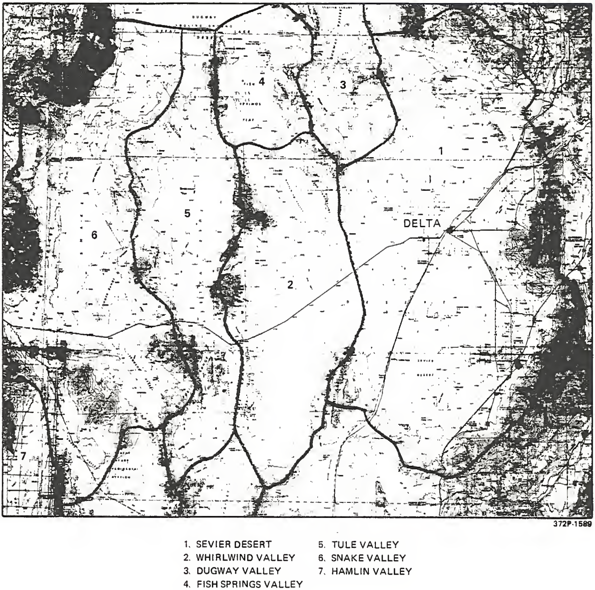

Figure 1. The study area.

served to increase the number of sites at large distances from water than was actually the case in the past. In partial compensation for this, the second variable considered is the topographic setting of each site, with categories for features that result from extinct water sources. Such features include beach lines, lake inlets, dunes, and old river channels. When these features were not found in close proximity to a site, then it was noted whether the site was in a valley or mountain setting.

The general topographic settings of all known sites within the study region are summarized in Table 1, which clearly shows a predominance of valley over mountain settings. While both mountain and valley resources likely contributed to the aboriginal subsistence base in this area, these data do establish that significant archaeological remains are to be expected within valley contexts, the setting within which all of the current survey was conducted.

Consideration of the proximity to water sources of the known archaeological sites provides some insight into how critical water availability is as a determining factor for site location in an environment as arid as western Utah (Table 2). Of the 44 sites whose relationship to water was classified as indeterminate, 27 are along old beach lines, five were on old river channels or lake inlets, and two could not be plotted. This means that nearly 80 percent of all known sites within the study region are within 2 km or less of a modern or extinct water source. Thus, current information supports the not surprising conclusion that areas around water sources have a much higher probability of containing archaeological remains (cf. Lindsay and Sargent 1977:82). Of special significance is the fact that this survey primarily involves areas that are not presently well-watered. Therefore, this survey provides a small, dispersed sample of an environmental setting that has been greatly underrepresented in previous archaeological surveys in the study region.

A final factor that needs to be noted is the relatively high frequency with which known sites were associated with dunes. Of the 134 sites that were located within valleys, 73 (54 percent) were reported as being on or adjacent to dunes. Thus dunes-especially in association with water--are another environmental indicator of areas where aboriginal sites are more likely to occur.

13. Environmental Setting: FUGRO's test locations were planned so as to provide information on cross sections of Tule, Dugway, Fish Springs, Snake, Hamlin, Whirlwind, and Sevier Lake valleys. In all cases, the existing roads in the valleys allowed this goal to be achieved by placing the test sites along the road edge. These transects generally occurred below 6,000 ft elevation, and all were placed within the alluvial deposits of the valleys, entirely avoiding the mountains.

Vegetation. The characteristic plant species observed in these valleys include shadscale, four wing saltbush, greasewood, rabbitbrush, Indian rice grass, winterfat, sage, and grasses. Halogeton was common

Table 1. General topographic setting of known archaeological sites in the Utah Study Region.

| VALLEY | NUMBER OF SITES BY TOPOGRAPHIC SETTING | | TOTAL |
|---|---|---|---|
| | MOUNTAIN | VALLEY | |
| Sevier Desert | 0 | 18 | 18 |
| Whirlwind | 2 | 12 | 16 |
| Dugway | 0 | 2 | 2 |
| Fish Springs | 4 | 11 | 15 |
| Tule | 6 | 73 | 79 |
| Snake | 28 | 18 | 46 |
| Total | 40 (23%) | 134 (77%) | 174 |

Table 2. Distance to permanent water for known archaeological sites in the Utah Study Region.

| GENERAL TOPOGRAPHIC SETTING | 0 - 2 km (0 - 1.24 mi) | > 2 km (> 1.24 mi) | INDETERMINATE |
|---|---|---|---|
| Mountain | 25 (14%) | 18 (10%) | 0 |
| Valley | 71 (41%) | 16 (9%) | 44 (25%) |
| Total | 96 (55%) | 34 (20%) | 44 (25%) |

in disturbed areas. Juniper occurred at a few of the test sites at elevations above 5,000 ft on the margins of the valleys.

Animals. The wildlife observed during fieldwork included several species of lizards, jackrabbits, ground squirrels, badgers, antelope, and a variety of birds including golden eagles, prairie falcon, redtail hawks, ferruginous hawks, and marsh hawks. Other animal species not observed that would have been important to the aboriginal inhabitants of the area include mule deer, big horn sheep, and other small mammals. Bison were also known to have occurred in the general western Utah area in historic times. (Please refer to the accompanying biological report for the lists of plant and animal species encountered at each test site.)

14. Water Availability: While annual rainfall is generally low throughout the region under consideration, precipitation varies considerably with elevation and position. Annual rainfall amounts range from 1.0 to 9.0 inches in the saline desert areas to more than 30 inches at the higher elevations in the Deep Creek Mountains (Burnham, 1950). Permanent water in the form of seeps, springs, and streams are found in a number of valley and mountain locations. In the eastern portion of the study area, the Sevier River flows north and then west in the vicinity of Delta before it empties into Sevier Dry Lake. On the far west several perennial streams originate in the Deep Creek Mountains and flow eastward into Snake Valley, which with its abundant springs and marsh areas appears to be the most "watered" valley encountered on this survey. Permanent water in the intervening valleys occurs mainly in the form of springs. A number of springs are known in Tule and Fish Springs valleys, and maps indicate springs in the Swasey and Sawtooth Mountains of the House Range, in the Drum and Simpson Mountains, and along the bases of the Confusion Range, the Wah Wah Mountains, and the San Francisco and Beaver Lake Mountains. Pleistocene lakes would have provided water and marsh environments during the Paleo Indian to early Archaic periods, but the duration of these lakes as water sources is not presently known.

15. Field Examination Techniques: In all cases the Fugro test locations were placed on the edges of existing roads, and frequently the test sites were placed in disturbed areas such as bladed road shoulders and old road beds in an attempt to minimize impacts. Fugro proposes seven different kinds of activities, each of which will disturb a different amount of surface area (Table 3). An HDR archaeologist accompanied each of the two Fugro teams as they staked the areas where these activities are to be carried out in order to ensure that no significant archaeological remains occurred there.

The area surveyed varied with the type of proposed activity (Table 3). Since all of the proposed activity locations involve small areas, it was possible to intensively survey them in a very brief time. For proposed borings, trenches, test pits, wells and cone penetrometer tests, an area about 50 ft by 50 ft, or 75 ft by 50 ft was usually examined although the anticipated disturbance area is considerably

Table 3. The size of areas surveyed and the maximum amount of land to be impacted by the proposed activities of Fugro National, Inc.

| TYPE OF ACTIVITY | MAXIMUM IMPACT AREA (APPROXIMATE) | MINIMUM AREA SURVEYED (APPROXIMATE) |
|---|---|---|
| Boring (C) | 50 ft x 75 ft | 50 ft x 75 ft |
| Cone Penetrometer Test (C) | 15 ft x 20 ft | 25 ft x 25 ft |
| Seismic Refraction Line (SR) | 15 ft x 600 ft | 25 ft x 600 ft |
| Test Pit (P) | 15 ft x 20 ft | 25 ft x 25 ft |
| Trench (T) | 15 ft x 50 ft | 50 ft x 50 ft |
| Well (W) | 50 ft x 75 ft | 50 ft x 75 ft |
| Soil Sample (S) | 15 ft x 20 ft | 15 ft x 20 ft |

less. The survey procedure used was to make 4 or 5 walking passes through the area at 10 to 12 ft intervals. This ensured that the entire surface was thoroughly inspected for archaeological remains. Since seismic lines are much longer and narrower, a different survey method was used. First, a single, straight-line transect approximately 600 ft long was walked along the road edge where the seismic line is to be run. Then, a return transect about 25 ft from the road edge was walked in a zig-zag manner. This allowed intensive examination of the direct impact zone along the road edge as well as a buffer area adjacent to it. In addition to surface survey, all existing disturbance areas such as road cuts, wash banks, and animal burrows were examined where appropriate to determine whether subsurface deposits might be present. An additional small area (approximately 30 x 10 m) running perpendicular to the existing road was walked to increase slightly the survey sample for each valley and to ensure that at least some "undisturbed" area was included in the area surveyed at each activity location. Each FUGRO activity was staked, flagged, and marked with the planned activity. The stakes were usually placed in the center of the activity area. In areas where the FUGRO test sites conflicted with archaeological remains, the FUGRO test site was moved to an area devoid of artifacts. No artifacts were collected, nor were sites marked in any way.

16. Findings: As a result of this survey, no impacts to archaeological sites are anticipated from the proposed Fugro geotechnical tests. Most of the archeological sites encountered are sufficiently outside the test areas. Where test sites conflicted with archaeological remains, the test sites were moved to areas devoid of artifacts to ensure site avoidance. At one test site (DV-I1) in Dugway Valley, an extensive obsidian source area was encountered. In this case, because no suitable area completely devoid of artifacts could be found, the test site was placed in an abandoned road bed at the eastern periphery of the obsidian quarry area. Due to the previously disturbed nature of the road bed surface, any additional surface disturbance caused by the tests should not result in impacts to the integrity or research potential of this archaeological site. Fugro felt that the test could not be deleted from its program in Dugway Valley.

Archaeological remains were encountered at 36 of the 410 test locations. Four additional sites were found in the general vicinity of test locations. The nature and location of each of the archaeological remains are discussed below by candidate deployment parcel (CDP).

Dugway Candidate Deployment Parcel

The Dugway Candidate Deployment Parcel includes all of Dugway Valley from the southern boundary of Dugway Proving Ground south to the Sevier Desert area just west of Delta, Utah. The Dugway Valley is bounded on the west by the Dugway Range, the Thomas Range, and the Drum and Little Drum Mountains. On the east, the valley is bounded by the Simpson Mountains, the Slow Elk Hills, the Keg Mountains, an unnamed lava flow, and Smelter Knolls (Figure 2).

Only two previously recorded sites are known in Dugway Valley. These are obsidian scatters and one is classified as a possible source area. They are both located on the west side of the valley below the Drum Mountains. As a result of this survey, archaeological remains were encountered at 9 of the 88 proposed activity sites examined or at 10.2 percent of the test sites. In addition to these 9 sites, 3 other historic sites were encountered substantially outside the Fugro test sites, but they are included here (Table 4). Each of the twelve sites or artifacts are discussed below from north to south.

Vicinity DW-C: This site is comprised of the foundations and partial walls of at least one historic building, possibly a smelter and habitation. The walls are made of stone cemented together and the central furnace and chimney remain fairly intact. The smelter structure was fairly long and narrow, about 50 ft by 15 ft, with the furnace centrally located. A pile of rock rubble may indicate a second structure. Burned slag was concentrated in several piles but occurred throughout the site area. What ore was processed here is not known, but maps indicate a number of mines, possibly gold and silver, located at the north end of the Dugway Range just to the southwest of the smelter site. The Fugro test location (DWC) is about one half mi to the southwest. This site should not be impacted by the proposed tests.

DW-G: This is an isolated unutilized obsidian flake. It is located on the westside of the valley on an old beach line terrace top. The flake was sufficiently distant from the test site that no impacts are expected.

Vicinity DW-S: This is the site of the Riverbed Pony Express Station which operated between 1860-1861 and later became the route of the Overland Stagecoach from 1862-1869. A stone monument marks the location. Since the Fugro test site (DW-S) is located about 300 m (1,000 ft) east of the station, no impacts are expected.

Vicinity DW-C1: The Dugway Pony Express Station is located about 1.2 km (0.75 mi) to the west of Fugro Test DW-C1. A stone foundation and monument indicate its location. A pile of stones from the structure and some historic trash are also present. No impacts are expected from the proposed Fugro tests.

DW-C1: Also in the vicinity of this test site is the original Pony Express and Overland Stagecoach route which today appears as an old two-track road or trail. It was used between 1860-1869. Because the Simpson Springs-Callao road is well gravelled and parallels the Pony Express road, the portion of the route in Dugway Valley has not been developed into a main road as it has in portions of Fish Springs Valley. Because it has received so little recent use, this segment of the Pony Express route remains undisturbed, and revegetation is occurring in some areas. Mileposts are placed adjacent to the route. Fugro test DW-C1 was moved from the Pony Express route south to an intersecting road which runs north-south to avoid potential impacts to the route. Other Fugro test sites were placed along the Simpsons

Table 4. Archaeological remains from Dugway CDP.

| ACTIVITY LOCATION/ LEGAL DESCRIPTION | SITE TYPE | SITE DESCRIPTION | MITIGATION MEASURES |
|---|---|---|---|
| (Vicinity DW-C)<br>*T9S, R12W, S25, SE/NE | MA | Historic smelter/ habitation site | Outside impact area |
| DW-G<br>T10S, R11W, S14, NE/NW | IR | Obsidian flake | Outside impact area |
| *T10S, R9W, S18, NE/NE<br>(Vicinity DW-S) | MA | Riverbed Pony Express Station | Outside impact area |
| *T11S, R11W, S13, SE/SW<br>(Vicinity DW-C1) | MA | Dugway Pony Express Station | Outside impact area |
| DW-C1<br>T11S, R10W, S18, NW/SW | LA | Pony Express and Overland Stage Route | Moved test from route |
| DW-I1<br>T12S, R11W, S22, S 1/2 and S27, N 1/2 | LA | Obsidian source area and tool manufacture and use area | Moved test site twice to a disturbed road surface near the east edge of the site |
| DW-M1<br>T12S, R10W, S28, SW/NW | IR | Obsidian flake | Test site moved |
| DW-N1<br>T12S, R10W, S27, NE/SW | IR | Quartzite biface | Outside impact area |
| DW-A2<br>T13S, R10W, S32, NW/NW | IR | Gold chert biface | Outside impact area |
| DW-W1<br>T13S, R11W, S35, NW/SE | IR | Gold chert uniface | Outside impact area |
| DW-I2<br>T14S, R11W, S24, NE/SE | IR | Utilized gold chert flake and shatter | Outside impact area |
| DW-C3<br>T16S, R9W, S18, NW/SW | IR | Broken, unutilized gold chert flake | Outside impact area |

*The site was not encountered at a Fugro activity location.

MA = Multiple Activity Site; LA = Limited Activity Site; IR = Isolated Remain

Springs-Callao road or other north-south roads, again to avoid any possible impacts to the historic route.

DW-I1: This is an extensive obsidian source area and tool manufacturing site. Obsidian occurs abundantly as nodules along a ridge top running for about 1.6 km (1 mi) from the Pismire Knolls in the Thomas Range eastward to some igneous rock outcrops. This ridge is located just south of Pismire Wash. While most of the obsidian is unworked, both utilized and unutilized flakes, cores, and debitage are common. A number of unifacial and bifacial tools were observed, but no projectile points were noted. Discrete loci of artifacts comprised mainly of unutilized flakes and shatter may indicate individual manufacturing locations. No features or other artifacts such as ceramics or groundstone were noted, but due to the large site area and the lack of time, the site was not fully examined and these cultural remains may be present here. Both unworked and worked obsidian is much more abundant higher on the ridge toward the mountains than lower toward the valley. Disturbance at this site is relatively high. Numerous roads intersect here, and typically they are placed along the highest portion of the ridge.

The Fugro test location (DW-I1) was originally planned at the intersection of two roads relatively high on the ridge in an area of dense cultural material and unmodified obsidian nodules. Another potential test location farther down the ridge was examined, but it, too, had cultural material. It was requested, at this time, that this test site be deleted, but Fugro felt that the test was necessary for their program in Dugway Valley. The test site was then moved again farther down the ridge toward the valley, approximately three quarters of a mile from its planned location. Substantially less obsidian occurs lower on the ridge than higher; however, no suitable area completely devoid of artifacts could be found adjacent to the main road. Consequently, the test site was placed in an abandoned road bed which spurred off to the southeast of the main road. The tests are therefore planned in a disturbed area close to the eastern periphery of the site. Any additional surface disturbance caused by the tests should not result in impacts to the integrity or research potential of this archaeological site.

DW-N1: An isolated obsidian flake was found here which exhibited use wear along one edge. No other cultural remains were noted. Since this artifact was within the disturbance area of the test, the test location was moved.

DW-N1: This is a large rectangular tool (11 x 7 cm) exhibiting bifacial retouch along one edge and unifacial retouch along another. Both edges showed considerable use wear. Made of a tabular piece of fine grained pink quartzite, the unifacial retouch was fairly uniform and continuous along one edge. The bifacial retouch along the opposite edge was somewhat irregular and exhibited more use wear. No other cultural material was noted. The Fugro test site was placed at a sufficient distance that no impacts are expected

DW-A2: This is an isolated gold chert or chalcedony tool exhibiting bifacial retouch along two parallel edges. Use wear was noted on both edges. The edges formed a point at one end suggesting possible use as a reaming tool. This artifact is outside the Fugro test area, and no impacts are expected.

DW-W1: This is an isolated tool made from a small tabular piece of gold chert, rectangular in cross section. It has steep unifacial retouch along one edge. It is outside the Fugro test area, and no impacts are anticipated.

DW-I2: The artifacts encountered here include one utilized flake and one piece of shatter. Both are made of the same material, a dark gold chalcedony. The flake exhibited heavy use wear. These artifacts are outside the Fugro test areas and no impacts are expected.

DW-C3: This is an isolated gold chert flake. Its distal end was broken and no use wear was noted. It was found in a playa area and may well have been washed in from elsewhere. It was outside the test areas, and no impacts are expected.

Tule Candidate Deployment Parcel

Tule CDP is approximately 130 km (80 mi) long, running from the southern edge of the Great Salt Lake Desert on the north and opening into the Wah Wah Valley in the south. The Fish Springs and House Ranges are the eastern boundary of the valley, while the Confusion Range bounds the valley on the west (Figure 3). Previous research was concentrated in the north central portion of the valley where Berge (1964) found a high density of campsites and lithic scatters around springs and old beach lines. No archaeological remains were recorded for the southern portion of the valley prior to this survey. A total of 173 activity locations was examined in Tule Valley, and archaeological remains were found at 15 of those locations (8.7 percent). Remains were most common in the northernmost portion of Tule CDP where Snake and Tule valleys merge with one another along the southern margin. The remains encountered in Tule CDP are briefly described, beginning in the northern end of the valley and continuing toward the south (Table 5).

TV-F6. A light surface scatter of small flakes of obsidian and basalt that covers an area at least 40 m by 10 m. Closest boundary of the site is 20 m from the Fugro stakes, therefore no impacts to archaeological remains are anticipated.

TV-I6. About 10 small flakes of obsidian and fine-grained basalt were noted in the area immediately surrounding the Fugro stake. Some of the obsidian had been sufficiently sand-blasted to round its edges. In order to avoid impacting these remains this activity was moved to the north side of the highway.

TV-L6. A surface scatter of obsidian flakes with an occasional flake

Table 5. Archaeological remains from the Tule CDP.

| ACTIVITY LOCATION/ LEGAL DESCRIPTION | SITE TYPE | SITE DESCRIPTION | MITIGATION MEASURES |
|---|---|---|---|
| TV-F6<br>T11S, R16W, S9, NE/SW | LA | Surface scatter of obsidian, basalt flakes | Outside impact area |
| TV-I6<br>T11S, R16W, S23, NW/NE | LA | Surface scatter of obsidian, basalt flakes | Activity moved |
| TV-L6<br>T11S, R15W, S28, NW/NE | LA | Surface Scatter of obsidian chert, jasper flakes | Activity moved |
| Vicinity of TV-L6<br>T11S, R15W, S28, NE/NW | MA | Pony Express Station | Over 500 m from impact area |
| TV-N5<br>T13S, R15W, S22, SW/SE | IR | One piece of chert shatter | Artifact moved |
| TV-D5<br>T14S, R15W, S3 SE/NE | IR | Possible flake | Outside impact area |
| TV-N4<br>T15S, R15W, S6, SE/NW | IR | Five flakes of gold chert | Outside impact area |
| TV-P2<br>T19S, R14W, S6, NE/NW | MA | Recent historic homestead | Outside impact area |
| TV-E1<br>T22S, R14W, S6, SE/NW | IR | One obsidian flake fragment | Artifact moved |
| TV-C1<br>T22S, R14W, S12, SE/NW | IR | Four quartzite lithics | Outside impact area |
| TV-Y<br>T23S, R14W, S9, NW/SW | IR | One piece of jasper shatter | Outside impact area |
| TV-W<br>T23S, R14W, S20, SW/NW | IR | Obsidian projectile point fragment | Outside impact area |
| TV-C<br>T24S, R15W, S1, SE/NE | IR | One quartzite flake | Outside impact area |
| TV-S<br>T24S, R13W, S18, SW/NE | IR | One obsidian flake fragment | Outside impact area |

MA = Multiple Activity Site; LA = Limited Activity Site; IR = Isolated Remain of chert and red jasper. The site measures at least 50 m east-west and extends both north and south of the road. At least one of the jasper flakes had been struck from a biface indicating that tool manufacture or repair was one of the activities that took place here. In order to avoid impacts to this site, the activity location was moved to the north side of the road and was placed over 60 m farther to the east.

Approximately 500 m west of TV-L6 is the Boyd Pony Express Station, which has been developed as a public exhibit by the BLM. Stone walls set in cement still stand over a meter high in some parts of this building which was occupied by station keeper Bird Boyd until the early 20th century. The structure has been fenced and is well outside any Fugro activity locations.

TV-M6. A scatter of less than 10 obsidian flakes was observed within an area about 3 m in diameter. About 10 m away several isolated obsidian flakes were also noted. Since all remains were 25 m or more away from the Fugro stakes, no impacts are anticipated.

TV-N5. A piece of chert shatter that measured 4 x 1.8 x 1.6 cm was observed in the disturbed area immediately adjacent to the existing road. Because this area was already disturbed the activity location was not changed, rather the single artifact was moved to the opposite side of the road. No impacts are anticipated.

TV-D5. A possible secondary decortication flake was found about 10 m from the Fugro stake. Since it could not be determined whether this item was intentionally produced and since it is outside the proposed disturbance area, no impacts are anticipated.

TV-N4. Five flakes of gold chert were found on a desert pavement surface. Patination was well-developed on the exposed surfaces of these flakes. All were struck from the same core, which was not found. These remains probably represent a single chipping episode. The artifacts are over 30 m from Fugro's stakes and will not be impacted by the proposed activities.

TV-P2. Two long, narrow foundations, probably for house trailers, were noted on the surface and four subterranean structures or foundations were found. Of the latter, one was small and square (ca. 1 m x 1 m), and was probably a privy. A large number of rusty cans were observed in the bottom of this structure. A second structure may have been a root cellar. It consisted of a square excavation (ca. 3.5 m on a side and at least 1.5 m deep) which was lined with stone walls. The downslope side had a long narrow entranceway. Presumably this structure was originally roofed. The other subterranean structures were roofed with earth, and the roofs were beginning to collapse. These structures were large and rectangular (ca. 8 m x 3 m), and no entrances to them were noted. Their function is unknown. The two foundations that probably supported trailers consisted of three or four courses of dry laid stones atop which a narrow cap of cement had been laid. A well on the south side of the road would have provided water for the users of these buildings. Occupation of these structures is probably quite recent (post World War II) judging from the large size of the trailer foundations and the lack of cans or glass that might suggest earlier use. Despite this, the site is of potential significance in that it provides information about the lifeways of the few individuals who have chosen to support themselves in the more arid portions of western Utah in recent times. Fugro's activities are located on the south side of the road and are far enough to the east that no impacts to these remains are anticipated.

TV-E1. A single obsidian flake that measured 2.5 cm x 2.2 cm was located about 4 m from a Fugro stake. A close inspection was made of the surface near this item, but no other artifacts were noted. Rather than relocate the activity, the artifact was simply moved 10 m to the south. Thus, no impacts should occur.

TV-C1: Four flakes and flake fragments of either pink or white medium-grained quartzite were found in a previously disturbed area along the road. Since the seismic tests are to occur right along the road margin and since the area had been disturbed previously, neither the location of the activity nor the artifacts was changed. No archeological impacts should occur as a result of the seismic tests.

TV-Y: A single small piece of pink-orange jasper shatter was found about 10 m from the road margin where the seismic test will occur. No impacts to this artifact should occur as a result of this test.

TV-W: A mid-section of an obsidian projectile point was found, but not enough of the artifact was present to reconstruct its original shape. The point fragment was located about 8 m from the road margin where the seismic test will occur, therefore, no impacts are anticipated.

TV-C: A single unutilized flake of medium-grained white quartzite. The flake measured 4.5 cm x 4.5 cm and it appears to be the same type of raw material as was found at TV-C1. This flake was about 15 m from the Fugro stake and should not be impacted by their activities.

TV-S: One utilized flake fragment of mahogany obsidian was found 50 m from the Fugro stake. No impact is anticipated since the artifact is well outside the proposed area of disturbance.

Fish Springs Candidate Deployment Parcel

Fish Springs CDP is only 40 km (25 mi) from north to south. The Fish Springs Range bounds the west side of the valley and the Thomas Range is the eastern boundary. An area of low mountains separates the valley from Whirlwind Valley on the south, while it opens onto the Great Salt Lake Desert to the north (Figure 4). Previous research has been concentrated around Fish Springs National Wildlife Refuge and a significant number of sites have been documented there. During this study archaeological remains were encountered at five of the 19 activity locations examined or 26.3 percent (Table 6).

Table 6. Archaeological remains from Fish Springs CDP.

| ACTIVITY LOCATION/ LEGAL DESCRIPTION | SITE TYPE | SITE DESCRIPTION | MITIGATION MEASURES |
|---|---|---|---|
| FS-G9<br>T12S, R14W, S36, SW/NW | IR | Obsidian flake | Outside impact area |
| FS-K9<br>T13S, R13W, S9, SW/NE | IR | Possible obsidian core | Outside impact area |
| FS-L9<br>T13S, R13W, S10, SE/SW | IR | Obsidian flake fragment | Artifact moved |
| FS-N9<br>T13S, R13W, S14, SW/SE | IR | Three obsidian flakes | Outside impact area |
| FS-P9<br>T13S, R11W, S30, NE/NW | LA | Lithic scatter, possibly hunting related or brief campsite | Outside impact area |

LA = Limited activity Site

IR = Isolated Remain

FS-G7: One small, unutilized obsidian flake. The flake is 12 m from the Fugro stakes and is unlikely to be disturbed by the proposed activities.

FS-K9: A possible core of obsidian that measured 5 cm x 4.5 cm. Two flakes had been removed from one face of this artifact and one flake was removed from a second face. No utilized edges were observed. Since the flakes do not seem to have been removed in order to modify this nodule into a usable tool, it is most likely that this nodule functioned as a core. No waste flakes were found nearby. The artifact was 30 m from the Fugro stake and will not be disturbed by the proposed activities.

FS-L9: A small obsidian flake fragment with one utilized edge. The utilized edge has an acute edge angle. The flake was located 8 m from the Fugro stake. Since no other artifacts were found nearby the artifact was moved another 5 m farther away from the stake. No further impacts are anticipated.

FS-N9: Three obsidian artifacts were found about 15 m from the Fugro stake. One artifact was a flake fragment, one a primary flake, and the third was a piece of shatter. In addition, small unused obsidian nodules occur on the surface in this area. Since these artifacts are at the approximate limit of the proposed disturbed area, they are unlikely to be disturbed by well drilling activities. Therefore, no impacts are anticipated.

FS-P9: This is a small lithic scatter comprised of unutilized and utilized flakes, shatter, at least three unifaces, and one broken, unfinished projectile point. These were all made of the same material, a brown mottled chert or chalcedony. The projectile point was triangular in shape with a broken stemmed base. It measured nearly 3 cm long by 1.6 cm wide. Only one side (face) was thinned and retouched along the edges. The opposite side had not been thinned or retouched which left the point thick in cross section. The stemmed base was broken at the bottom of the stem which measured 1.1 cm wide. The point appears to have been discarded in an unfinished state, perhaps because of the broken base. The site area is highly disturbed. The road right-of-way has been bladed here to a width of about 8 m, and a water bar has been dug through the site as well. The artifacts were found in a disturbed triangle formed by the bladed right-of-way and the water bar. Other pieces of brown chalcedony were noted in the bladed area. While no other artifacts or features were noted, this site may have been a campsite or it may represent hunting related activities. The Fugro test site was outside the archaeological site area, and no impacts are expected.

## Hamlin Candidate Deployment Parcel

Only 10 test locations were examined in Hamlin CDP (Figure 5), and none of them contained archaeological remains.

## Whirlwind Candidate Deployment Parcel

The Whirlwind CDP is about 90 km (56 mi) from north to south. On the north it is separated from Fish Springs Valley by east-west trending low hills, while the east and west boundaries are the Drum and Swasey Mountains, respectively. To the south the valley is much broader and it includes the Sevier Lake. It is bounded on the east by the Cricket Mountains and on the west by the House Range (Figure 6). Previous research has been concentrated primarily around the area where the Sevier River empties into Sevier Lake and several sites are known from that area. Archaeological remains were encountered at two of the 32 (6.3 percent) activity locations examined during the survey (Table 7).

WW-I9: A single unutilized flake of gray chert that measured 4.5 by 2.2 cm. The flake was gound 30 m away from the Fugro stake, therefore no impacts are anticipated.

WW-H: An unutilized flake of medium-grained,pink quartzite that measured approximately 5.5 x 1.5 cm. This raw material closely resembles that found at Tule Valley locations TV-C1 and TV-C. The flake was located 50 m from the Fugro stake, therefore no impacts should occur.

## Snake East Candidate Deployment Parcel

Snake East CDP includes the eastern half of Snake Valley and the Ferguson Desert. It measures about 135 km (84 mi) from the Great Salt Lake Desert on the north to the Needle Range on the south (Figure 7). Snake East has less surface water and is generally more arid than Snake West. Previous research has documented very few archaeological remains in Snake East, and the present survey found remains at five of 58 activity locations (8.6 percent). All were in the southern portion of the survey area (Table 8).

SE-B1: A small lithic scatter of at least 20 flakes of medium-grained quartzite was found in the vicinity of the Fugro stakes on the south side of the road. A pink and a white material type were represented. The scatter occurred only within an area about 7 m in diameter and did not extend to the north side of the road where a seismic test is planned. In order to avoid impacts to this site, the Fugro activities on the south side of the road were moved 50 m to the east. No archaeological remains occur in this new area, which has already been somewhat disturbed by vehicles. Due to this change in location no archaeological impacts are anticipated here.

SE-S: A single medium-sized flake fragment of medium-grained quartzite was found lying on a surface of partially developed desert pavement. The artifact was 60 m from the Fugro stake and will not be affected by the proposed activities.

SE-U: A small lithic scatter about 20 m in diameter with most

Table 7. Archaeological remains from Whirlwind CDP.

| ACTIVITY LOCATION/ LEGAL DESCRIPTION | SITE TYPE | SITE DESCRIPTION | MITIGATION MEASURES |
|---|---|---|---|
| WW-I9<br>T19S, R11W, S29, NE/SW | IR | Gray chert flake | Outside impact area |
| WW-H<br>T22S, R13W, S13, NW/NW | IR | Pink quartzite flake | Outside impact area |

Table 8. Archaeological remains from Snake East CDP.

| ACTIVITY LOCATION/ LEGAL DESCRIPTION | SITE TYPE | SITE DESCRIPTION | MITIGATION MEASURES |
|---|---|---|---|
| SE-B1<br>T23S, R16W, S22, NE/NW | LA | Surface lithic scatter of quartzite flakes | Activity moved |
| SE-C1<br>T23S, R16W, S23, NW/NW | IR | Quartzite flake fragment | Outside impact area |
| SE-U<br>T24S, R16W, S17, NE/NE | LA | Lithic scatter, possibly hunting related | Outside impact area |
| SE-A<br>T24S, R19W, S24, SE/NE | IR | Quartzite flake | Outside impact area |
| SE-W<br>T24S, R19W, S25, SE/SE | IR | Basalt scraper | Artifact moved |

LA = Limited Activity

IR = Isolated Remain

artifacts observed within an area 3 m in diameter. Artifacts observed included a broken biface of medium-grained white quartzite, a broken biface of red and yellow jasper, a small flake of snowflake obsidian and several other small flakes of jasper. At least six material types were observed, though the total number of artifacts seen was about ten. The large number of material types relative to the total number of artifacts suggests that lithic use rather than manufacture was the principal activity at this site. The absence of any grinding tools and the presence of two bifaces suggests hunting-related activities occurred here. The site is 30 m from the proposed activity locations, therefore no direct impacts should occur. Because of the very low visibility of this site, indirect impacts resulting from unauthorized collecting are very unlikely.

SE-A: A small flake of white quartzite. All edges were acute angles but no definite use wear was visible. Flake was 40 m from the Fugro activity locations and will not be disturbed.

SE-W: A single scraper of fine-grained basalt was found near the Fugro stake. The artifact was a flake measuring 4.5 cm x 4.5 cm x 1.3 cm. The entire distal end of the flake had been unifacially retouched to form a steep angled working edge 4.5 cm long. The area around the stake was closely inspected and no additional remains were found. Therefore this artifact was relocated about 15 m farther to the northwest. No archaeological impacts are anticipated.

### Snake West Candidate Deployment Parcel

No archaeological remains were encountered at any of the 31 test sites that were examined in the Snake West CDP

### Discussion

It has been argued recently by Henderson (1979:5) that small-scale surveys such as this one can produce useful results if they are viewed as very small samples that add to the data base of an area and that can be supplemented by future small surveys within the same region. The existing data review established that the present study area is only poorly known archaeologically. While this situation remains unchanged as a result of this study, consideration of two topics in greater detail should facilitate the integration of the results of this study into the existing data base. The first topic is the effects of sampling bias on the results that were obtained. Second, is the question of the degree of variability in the density and diversity of archaeological remains in the various valleys that were examined here.

Two kinds of sampling biases that likely affected the results of this survey are considered. First is the overrepresentation of particular environmental settings. Second is the likelihood that the siting of all test locations along existing roads has resulted in fewer archaeological remains being encountered because of the high degree of existing disturbance in such areas. It has already been noted that all survey units examined were in valley settings, but several other criteria structured the choice of test areas by the engineers and geologists and almost certainly biased the archaeological results. One goal of the geological tests was to define depth to water table contours so that all land where depth to water table was 50 ft or less could be deleted from further consideration. Thus, there was a strong bias against inclusion of areas with surface water or high water tables. Given the relationship between water sources and aboriginal site locations that was discussed in the existing data review, it is clear that an area of generally high sensitivity was systematically excluded from our sample. Thus, it is unlikely that the full range of archaeological sites that might be expected to occur in valley settings are included in our sample. This may also help account for the lack of remains in the Snake West CDP, an area of relatively high water availability where a higher density of remains might be expected. There are probably other more subtle environmental biases in our sample that could be assessed if more time were available. However, the large number of sample units that were placed within most of the valleys has provided an essentially random sample if our sampling universe is considered to be the unwatered portions of the valleys.

A factor that lessens the value of this sample is the disturbed nature of the road margins along which test activities were placed. In order to assess the degree to which road margins contained fewer archaeological remains than did less disturbed areas slightly removed from the roads, additional sampling was done outside the direct impact areas. A quadrat at least 30 m long and 8 m wide was walked perpendicular to the road at 289 (70 percent) of the activity locations. In order to minimize delays, samples frequently were not taken at seismic tests, which required that a large direct impact area be examined, or when archaeological remains were encountered within a direct impact area. It is for these reasons that additional samples were not carried out at 100 percent of the test locations. If archaeological remains were randomly distributed along road margins and in adjacent undisturbed areas, then the frequency of remains should be roughly proportional to the amount of surface area examined in these two contexts. The direct impact areas covered 28.65 ha (70.8 acres), while the sample areas covered 8.1 ha (20 acres). Thus, about 78 percent of the observed archaeological remains should have occurred within direct impact areas and about 22 percent should have occurred in sample areas (Table 9). This is not the case, however, and a chi-squared test indicates that the results shown in Table 9 are statistically significant at slightly above the .025 level. This clearly suggests that caution must be used in making conclusions about the archaeological remains in undisturbed areas from surveys such as this one that include a significant amount of previously disturbed area.

Several brief comments are offered regarding the nature of variability in the archaeological remains of the six valleys studied (Table 10). First, all of the multiple activity sites date to the historic period, and three of the five are related to the Pony Express

Table 9. The frequency of occurrence of archaeological remains within direct impact areas along existing roads and in sample units farther removed from roads.

| LOCATION | FREQUENCY OF ARCHAEOLOGICAL REMAINS | |
|---|---|---|
| | OBSERVED | EXPECTED |
| Impact Areas | 21 | 25.7 |
| Sample Areas | 13 | 7.3 |

$\chi^2 = 5.3102$ df = 1 $p > 0.025$

Table 10. Archaeological remains encountered.

| CANDIDATE DEPLOYMENT PARCEL | SITE TYPE |  |  | NUMBER OF ARCHAEOLOGICAL SITES | NUMBER OF TEST LOCATIONS | PERCENTAGE OF TESTS WITH SITES |
|---|---|---|---|---|---|---|
|  | MULTIPLE ACTIVITY | LIMITED ACTIVITY | ISOLATED REMAINS |  |  |  |
| Tule | 2* | 2 | 12 | 16 | 173 | 8.7 |
| Dugway | 3* | 2 | 7 | 12 | 88 | 10.2 |
| Fish Springs | — | 1 | 4 | 5 | 19 | 26.3 |
| Hamlin | — | — | — | 0 | 10 | 0 |
| Whirlwind | — | — | 2 | 2 | 32 | 6.3 |
| Snake East | — | 2 | 3 | 5 | 58 | 8.6 |
| Snake West | — | — | — | 0 | 30 | 0 |
| Total | 5 | 7 | 28 | 40 | 410 | 8.8 |

*One multiple activity site from Tule CDP and three from Dugway CDP were located outside of the Fugro test locations. They are included in the site totals but were not used in calculating the percentages in the final column since they were not within an area that was intensively surveyed.

route. The high visibility of these sites is one factor contributing to these results. But the high frequency of historic multiple activity sites is probably an accurate reflection of past reality, for only during historic times when drilled wells ensured a water supply and food supplies could be obtained from distant sources was it feasible to establish permanent residence away from a natural water source. Aboriginal multiple activity sites are expected to be very infrequent in such settings.

The variability in the frequency of limited activity sites and isolated remains is difficult to account for given the very small size of our sample. However, two areas seem to have higher frequencies of remains than can be accounted for by sampling error alone. One is Fish Springs Valley where remains were noted in five of the 19 areas surveyed. The availability of water, marsh resources, and nearby obsidian sources (Anderson 1962) are the most likely factors that would account for greater aboriginal utilization of this area. The northern end of Tule and Snake Valleys (all within the Tule CDP) also had a very high density of aboriginal and historic remains. For Americans this area was an important transportation route, taking advantage of the water sources and avoiding the Great Salt Lake Desert immediately to the north. According to Malouf (1974) the Gosiute used this area in a somewhat similar manner. A great deal of Gosiute travel was between their two traditional population centers of Deep Creek on the west and the Skull Valley area to the northeast. Camps were frequently established at water sources between the two areas. A similar pattern may have existed in late prehistoric times as well. Thus, a significant portion of the archaeological remains may be due to the fact that this area formed a natural transportation route for both American and aboriginal groups.

The results of this survey suggest that there should be further research into the nature of lithic raw material procurement and use strategies in west central Utah. For example, obsidian is the predominant material type at the previously documented sites in the study area. It is noted as occurring on 133 of the 170 existing site records (78 percent), and was found at 54 percent of the Fugro test locations with lithics. One of these locations was an obsidian source area. The local occurrence of source areas, and the high frequency of obsidian at many archaeological sites presents an excellent opportunity for dating of these remains by the obsidian hydration method. This could allow a much greater degree of temporal control than is generally possible when investigating archaeological remains deposited primarily by hunter-gathers. It was also noted that within relatively localized areas a particular material type would occur at several different locations. For example, in Whirlwind, Southern Tule and Snake East CDPs, a medium-grained white or pink quartzite occurred at six different test locations. In addition, the brown chalcedony noted at FS-P9 was also reported by Anderson (1962:117) from two sites that he located within the Fish Springs National Wildlife Refuge. While the localized distribution of these raw material types suggests that they occur nearby, further investigation might also show that such remains were used for specific tasks or have temporal significance.

Without a better understanding of the function of the limited activity sites and isolated remains that occur in Great Basin valleys it is not possible to make further interpretations of the variability observed between the different valleys. These kinds of remains have received very little attention by Great Basin archaeologists, though Thomas (1973) has shown that they have the potential to answer significant anthropological questions.

17. National Register: Several of the archaeological sites encountered during this survey may have sufficient information potential or other qualities that would make them eligible for nomination to the National Register of Historic Places. These include:the three Pony Express/Overland Stage stations, Boyd, Dugway, and Riverbed, and the historic route itself; the larger lithic scatter (TV-L6) in Tule Valley; and the large obsidian source area (DW-I1) in Dugway Valley. More thorough documentation and assessment of these sites is necessary to determine their eligibility for the National Register. While the remaining isolated artifacts and limited activity sites do not individually have sufficient research potential to qualify them for the National Register, these sites, when considered together, can contribute significantly to our understanding of aboriginal adaptation, especially regarding settlement and subsistence patterns. Data recovery should be considered for these sites should future projects pose any potential impacts.

18. Summary and Mitigation Recommendations: An intensive survey of 410 proposed test locations in the Tule, Dugway, Fish Springs, Hamlin, Whirlwind, and Snake East and West candidate deployment parcels in western Utah was conducted by archaeologists from HDR Ecosciences. At 36 of these test locations, remains other than the recent trash were encountered, and three additional historic sites were noted in the general vicinity of some test sites. At all of these sites but one, the Fugro test site was either outside the direct impact zone or the test site was moved in order to avoid impacting these remains. It is, therefore, unlikely that implementation of the proposed program of test activities by Fugro National, Inc. will adversely impact any significant remains.

At the extensive obsidian source area in Dugway Valley, Fugro test DW-I1 was placed in an abandoned road bed in an area with a low density of cultural material. Due to the previously disturbed nature of the road bed surface, any additional surface disturbance caused by the tests should not result in impacts to the integrity or research potential of this site.

19. CR inventory acreage:

Intensive — 90.9(Table 11)

20. Time expenditure:

Table 11. The amount of area intensively surveyed within the seven Candidate Deployment Parcels.

| CANDIDATE DEPLOYMENT PARCEL | AREA INTENSIVELY SURVEYED | |
|---|---|---|
| | HECTARES | ACRES |
| Tule | 17.3 | 42.7 |
| Dugway | 7.2 | 17.8 |
| Fish Springs | 1.3 | 3.3 |
| Hamlin | 0.5 | 1.3 |
| Whirlwind | 2.9 | 7.2 |
| Snake East | 5.4 | 13.4 |
| Snake West | 2.1 | 5.2 |
| Total | 36.7 | 90.9 |

Field: 168 hours

Office: 80 hours

21. Submitted to BLM by:HDR Ecosciences; William H. Doelle, Archaeologist, Linda L. Mayro, Archaeologist; July 23, 1979.

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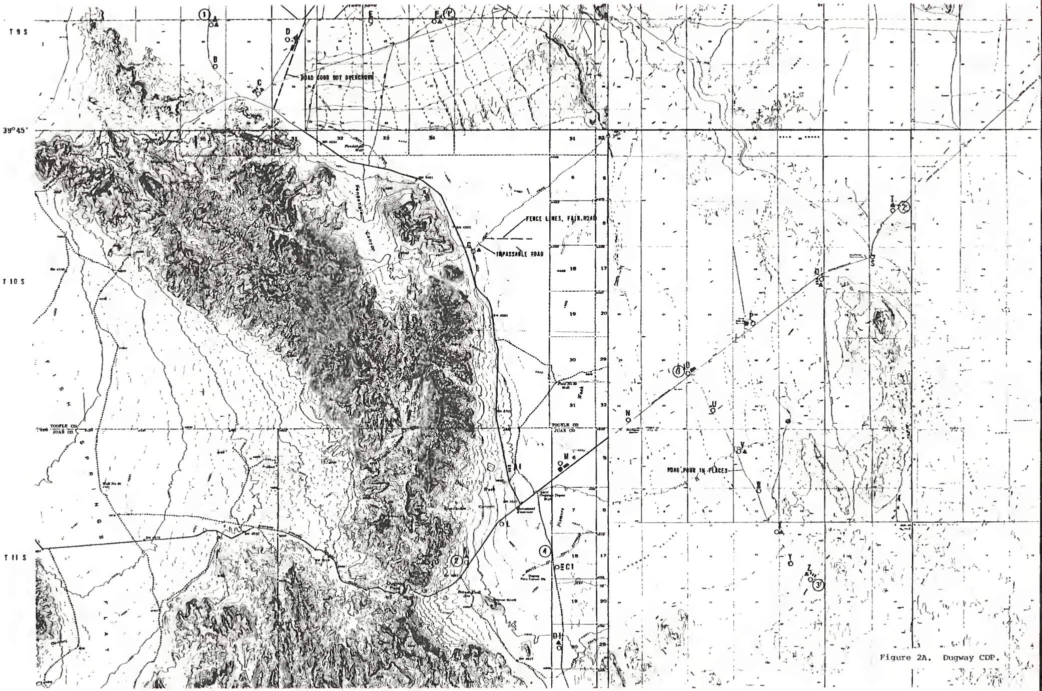


Figure 2A. Dugway CDP.

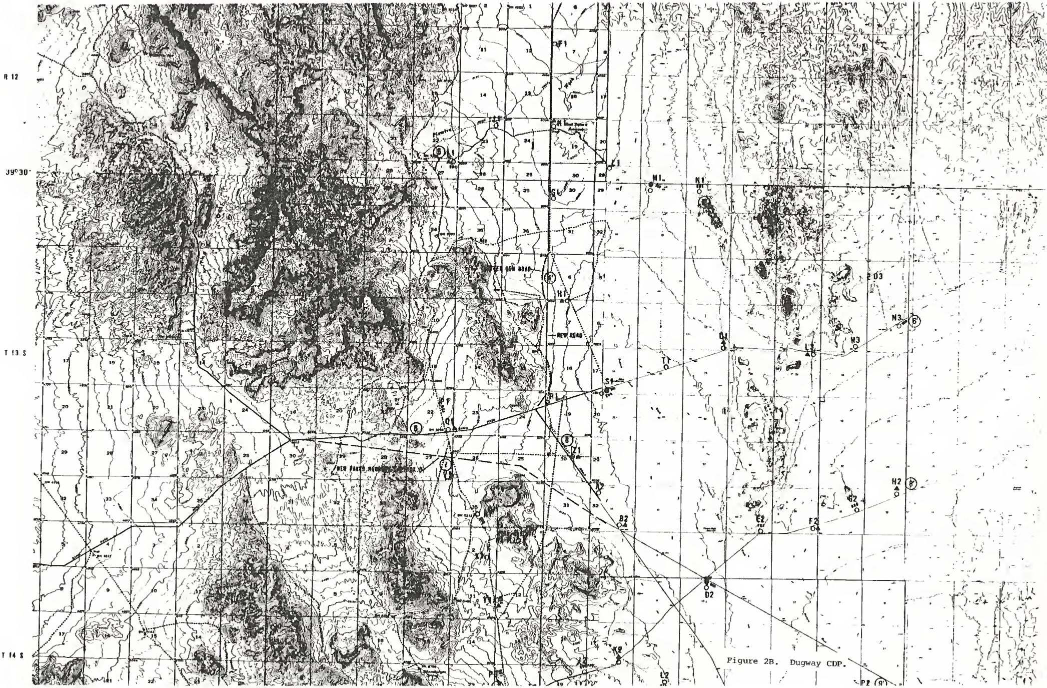


Figure 2B. Dugway CDP.

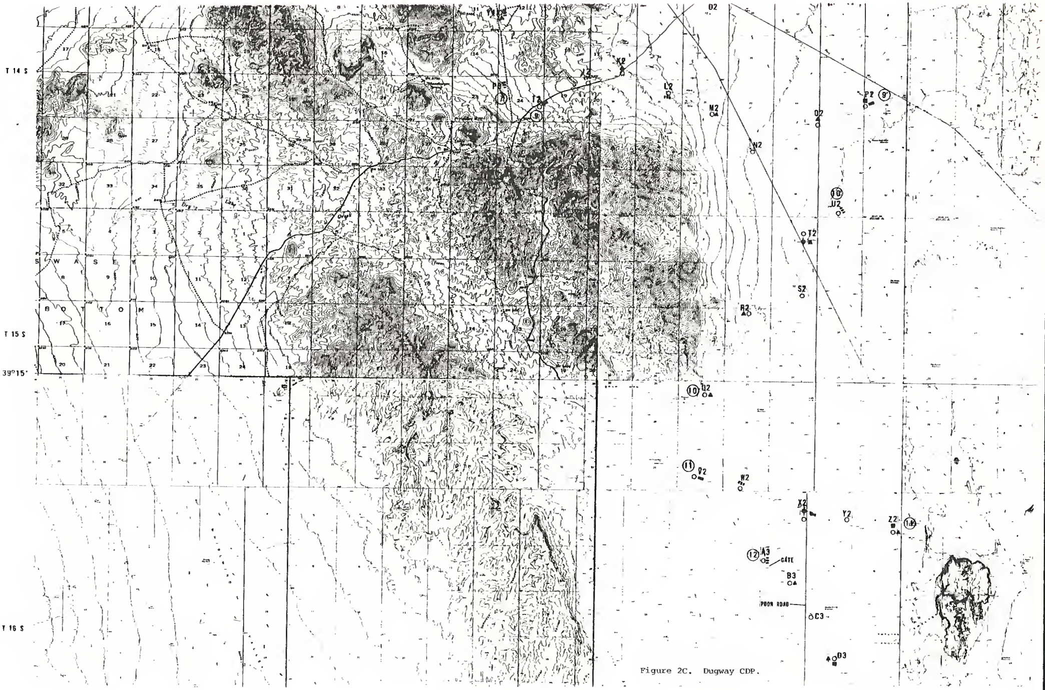
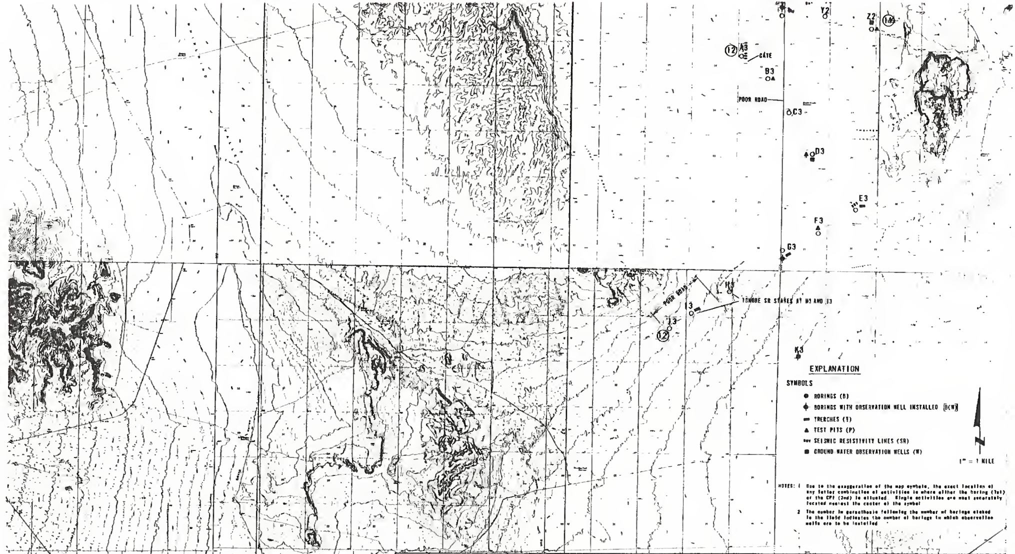


Figure 2C. Dugway CDP.



EXPLANATION

SYMBOLS

● BORINGS (B)

✦ BORINGS WITH OBSERVATION WELL INSTALLED [B(W)]

▬ TRENCHES (T)

▲ TEST PITS (P)

SEISMIC RESISTIVITY LINES (SR)

■ GROUND WATER OBSERVATION WELLS (W)

NOTES: 1 Due to the exaggeration of the map symbols, the exact location of any latter combination of activities is where either the boring (1st) or the CPT (2nd) is situated. Single activities are most accurately located nearest the center of the symbol.

2 The number in parenthesis following the number of borings staked in the field indicates the number of borings in which observation wells are to be installed.

| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | 8(4) |
| CPTs | 80 |
| TRENCHES | 18 |
| TEST PITS | 32 |
| SR LINES | 12 |
| OBSERVATION WELLS | 4 |

Figure 2D. Dugway CDP.

| REV. | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | 3 JUL 79 | STAKED AT LOCATION OF FIELD ACTIVITIES | mLL |

DUGWAY CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING

FUGRO NATIONAL, INC.

ATTACHMENT 4

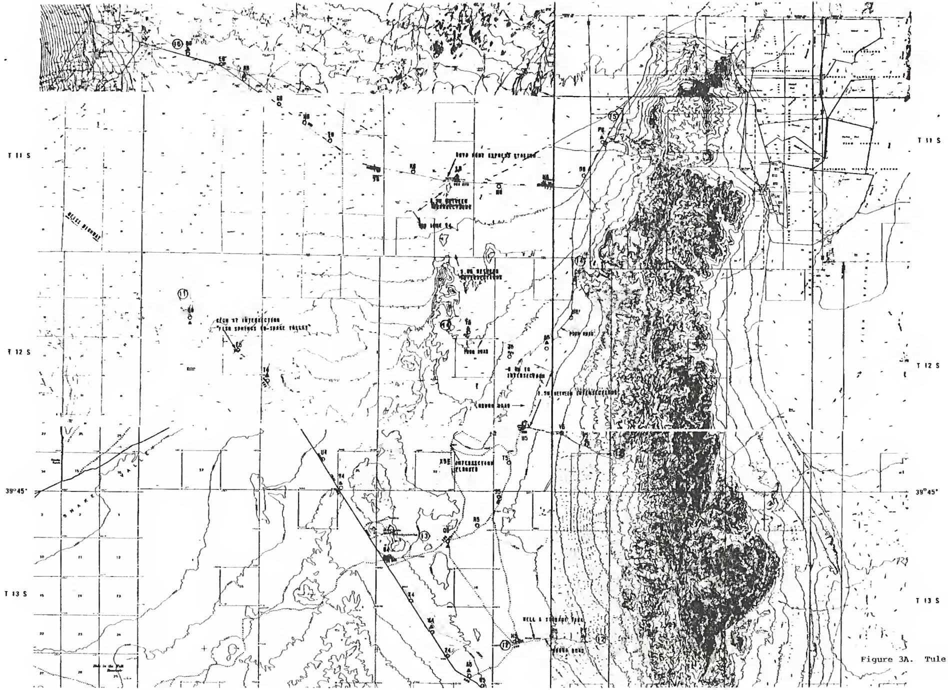


Figure 3A. Tule CDP

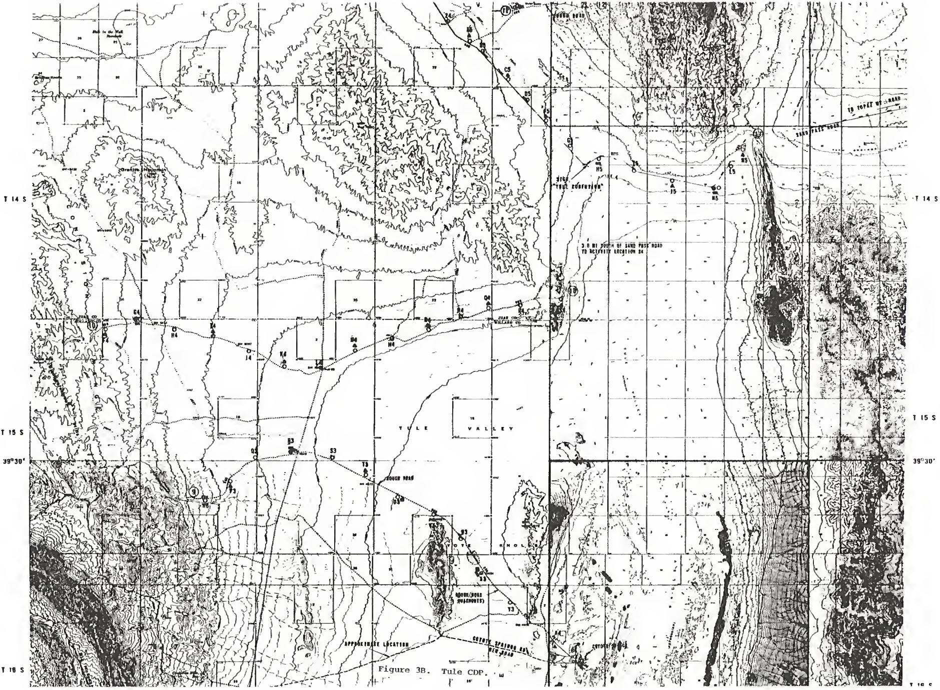
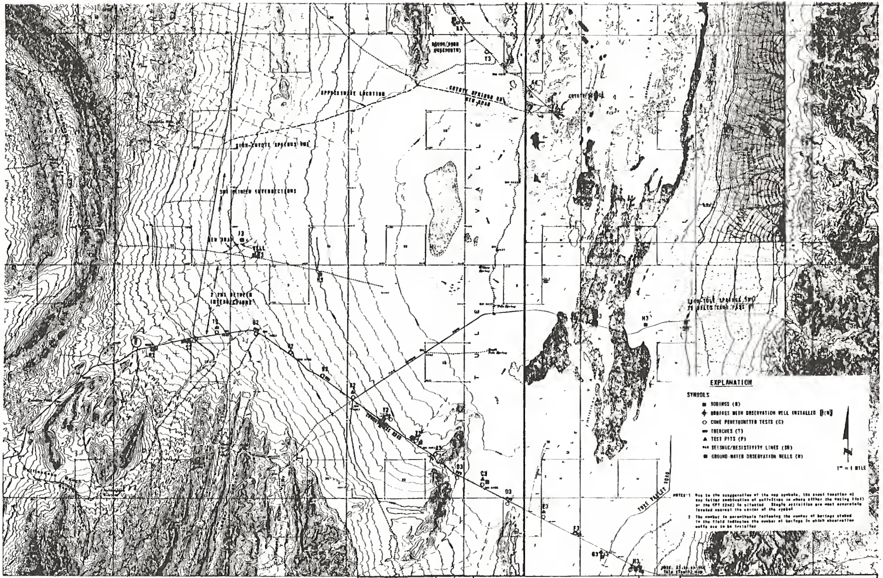


Figure 3B. Tule CDP.


T 16 S
T 17 S
T 18 S
R 16 W
APPROXIMATE LOCATION
COYOTE SPRINGS RD. NEW ROAD
COYOTE SPRINGS
TULE VALLEY ROAD
T U L E V A L L E Y
J3
T3
B2
C2
T2
B3
C3
D3
E3
F3
G3
H3
N3
EXPLANATION
SYMBOLS
BORINGS (B)
BORINGS WITH OBSERVATION WELL INSTALLED B(W)
CONE PENETROMETER TESTS (C)
TRENCHES (T)
TEST PITS (P)
SEISMIC/RESISTIVITY LINES (SR)
GROUND-WATER OBSERVATION WELLS (W)
1" = 1 MILE
NOTES: 1 Due to the exaggeration of the map symbols, the exact location of any letter combination of activities is where either the boring (1st) or the CPT (2nd) is situated. Single activities are most accurately located nearest the center of the symbol
2 The number in parentheses following the number of borings staked in the field indicates the number of borings in which observation wells are to be installed

| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | [illegible] |
| CPTs | [illegible] |
| TRENCHES | [illegible] |
| TEST PITS | [illegible] |
| SR LINES | [illegible] |
| OBSERVATION WELLS | [illegible] |

Figure 3C. Tule CDP.

| REV. | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | 3 JUL 79 | STAKED LOCATIONS OF FIELD ACTIVITIES | MLL |

TULE (NORTH) CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FUGRO NATIONAL, INC.

ATTACHMENT E

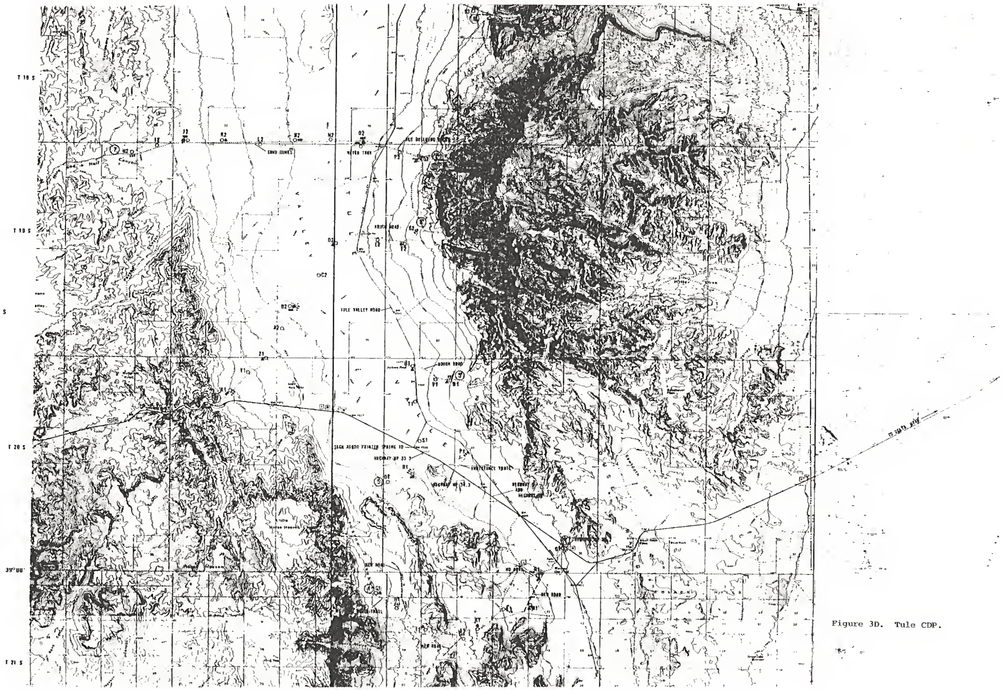


Figure 3D. Tule CDP.

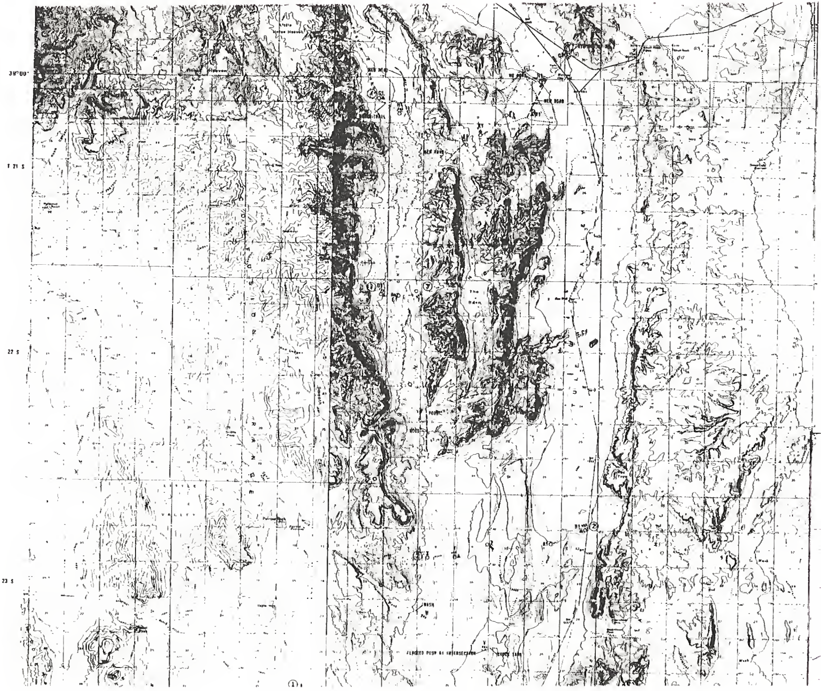
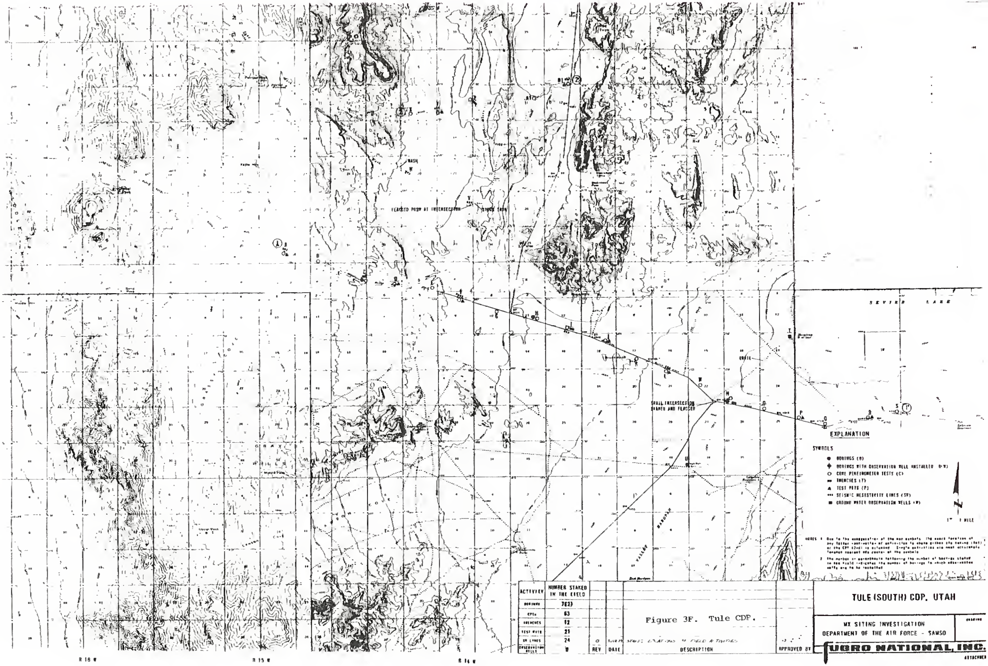


Figure 3E. Tule CDP.



SEVIER LAKE
VALLEY
WASH
FLAGGED POST AT INTERSECTION
SMALL INTERSECTION STAKED AND FLAGGED
23 S
24 S
T 25 S
R 16 W
R 15 W
R 14 W

EXPLANATION

SYMBOLS

- ● BORINGS (B)
- ◆ BORINGS WITH OBSERVATION WELL INSTALLED (B-W)
- ○ CONE PENETROMETER TESTS (C)
- ▬ TRENCHES (T)
- ▲ TEST PITS (P)
- ••• SEISMIC RESISTIVITY LINES (SR)
- ■ GROUND WATER OBSERVATION WELLS (W)

1" = 1 MILE

NOTES 1 Due to the exaggeration of the map symbols, the exact location of any [illegible] of activities [illegible] of the CPT [illegible] is [illegible]. Single activities are most accurately located [illegible] the center of the symbols.

2 The number in parentheses following the number of borings staked in the field indicates the number of borings in which observation wells are to be installed.

| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | 7(2) |
| CPTs | 63 |
| TRENCHES | 12 |
| TEST PITS | 21 |
| SR LINES | 24 |
| OBSERVATION WELLS | 9 |

| REV | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | [illegible] | STAKED LOCATIONS OF FIELD ACTIVITIES | [illegible] |

Figure 3F. Tule CDP.

TULE (SOUTH) CDP. UTAH

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ATTACHMENT

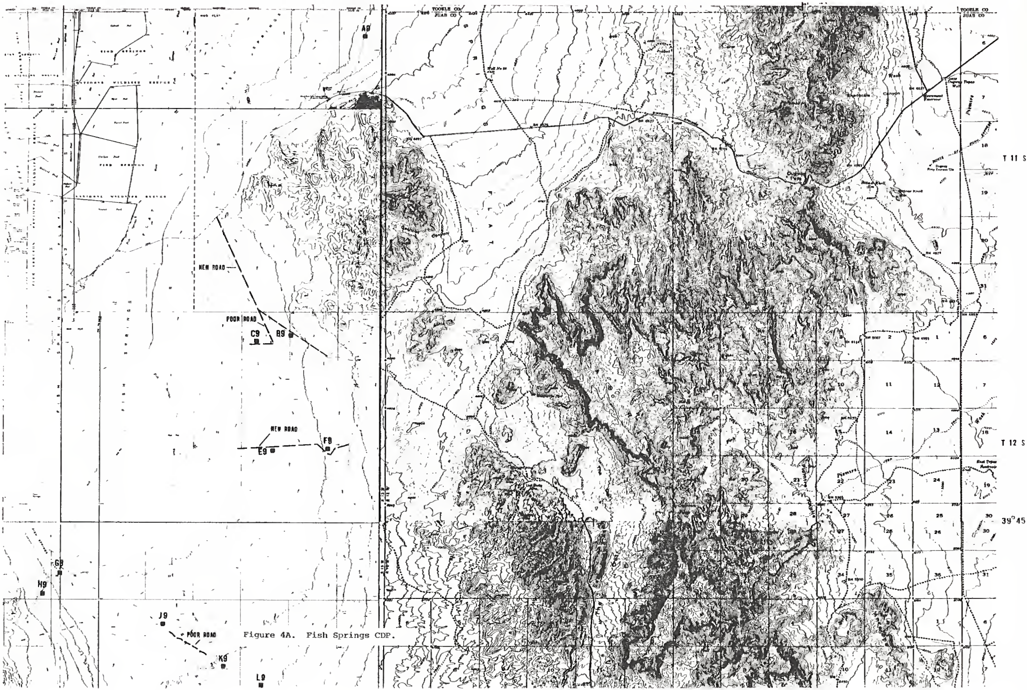
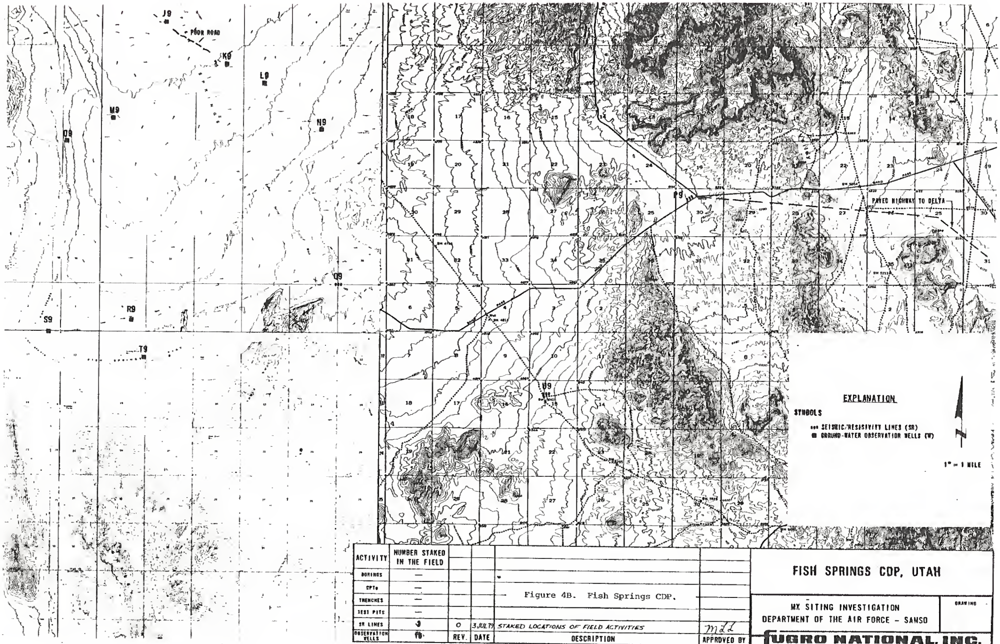


Figure 4A. Fish Springs CDP.



| ACTIVITY | NUMBER STAKED IN THE FIELD | | | |
|---|---|---|---|---|
| BORINGS | — | | | |
| CPTs | — | | Figure 4B. Fish Springs CDP. | |
| TRENCHES | — | | | |
| TEST PITS | — | | | |
| SR LINES | 3 | 0 | 3 JUL 79 STAKED LOCATIONS OF FIELD ACTIVITIES | mLL |
| OBSERVATION WELLS | 16 | REV. | DATE DESCRIPTION | APPROVED BY |

**FISH SPRINGS CDP, UTAH**

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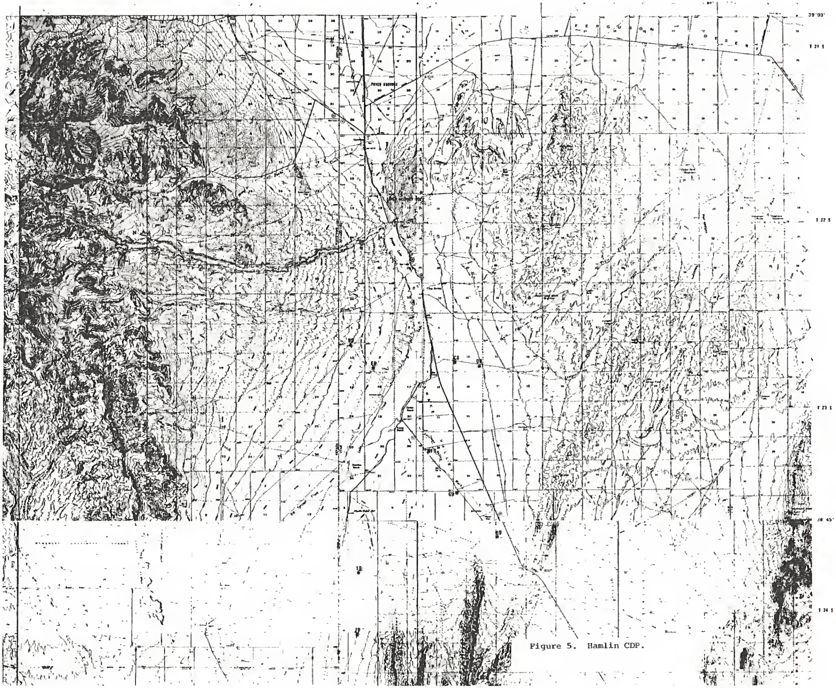

Figure 5. Hamlin CDP.

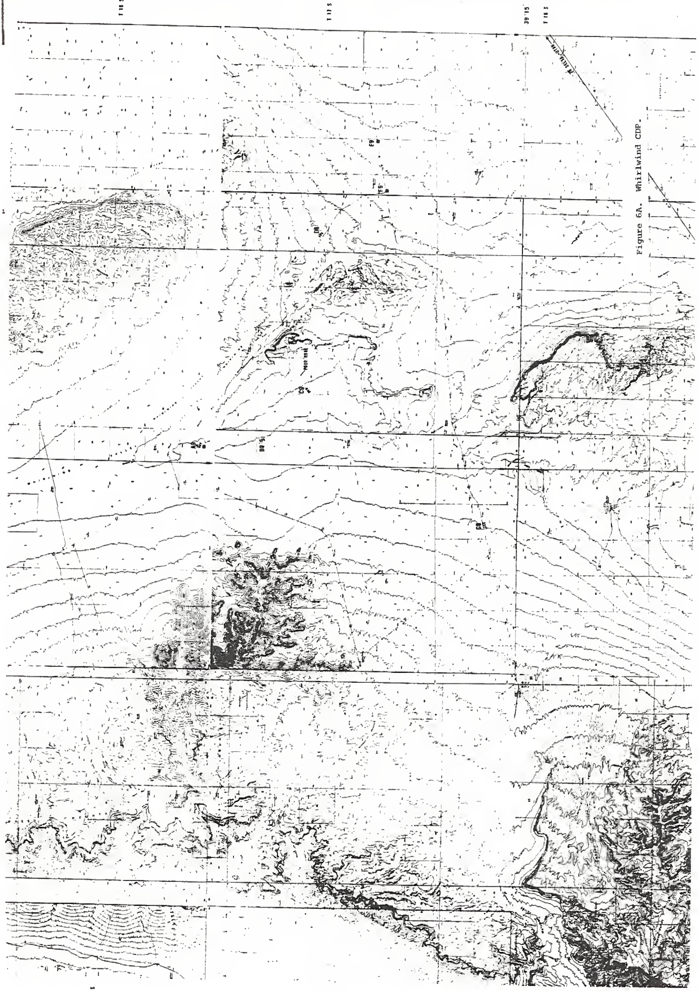

Figure 6A. Whirlwind CDP.

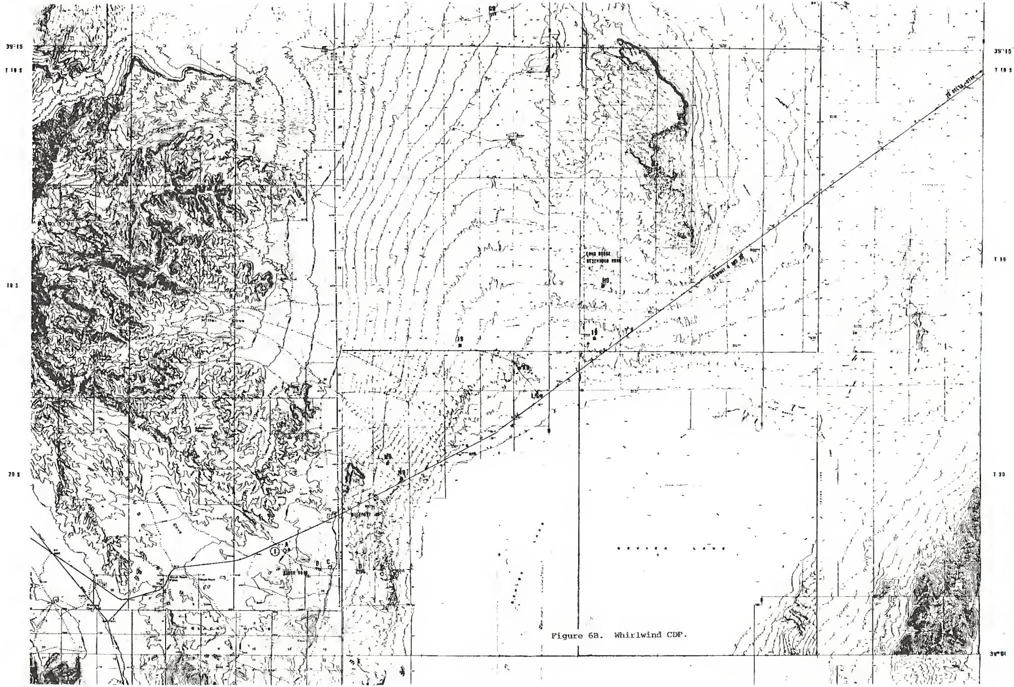

Figure 6B. Whirlwind CDF.

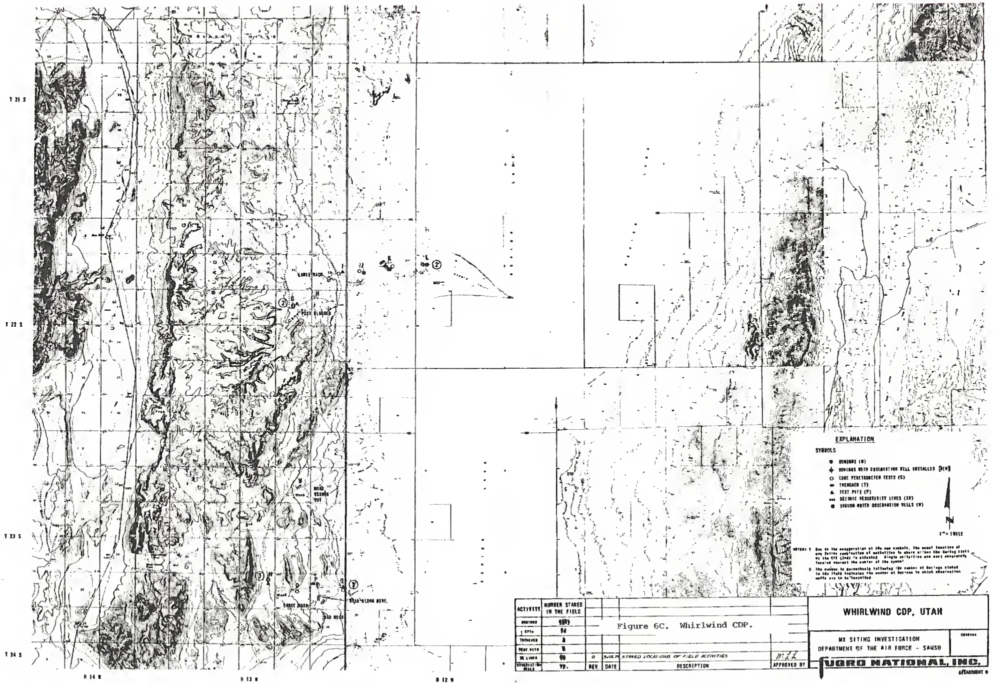

Figure 6C. Whirlwind CDP.

EXPLANATION

SYMBOLS

- ● BORINGS (B)
- ✦ BORINGS WITH OBSERVATION WELL INSTALLED [B(W)]
- ○ CONE PENETROMETER TESTS (C)
- ▬ TRENCHES (T)
- ▲ TEST PITS (P)
- ▪▪▪ SEISMIC RESISTIVITY LINES (SR)
- ■ GROUND WATER OBSERVATION WELLS (W)

NOTES: 1 [illegible]

2 [illegible]

| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | [illegible] |
| CPTs | 14 |
| TRENCHES | 3 |
| TEST PITS | 5 |
| SR LINES | [illegible] |
| OBSERVATION WELLS | [illegible] |

| REV | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | 5-JUL-79 | STAKED LOCATIONS OF FIELD ACTIVITIES | MLL |

WHIRLWIND CDP, UTAH

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ATTACHMENT 6

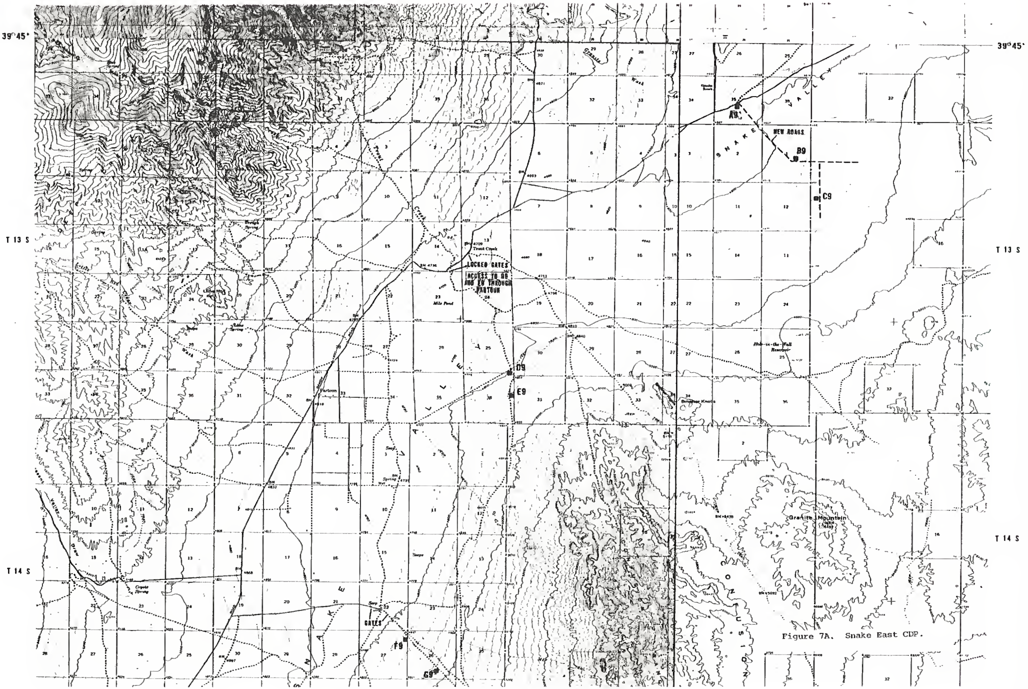


Figure 7A. Snake East CDP.

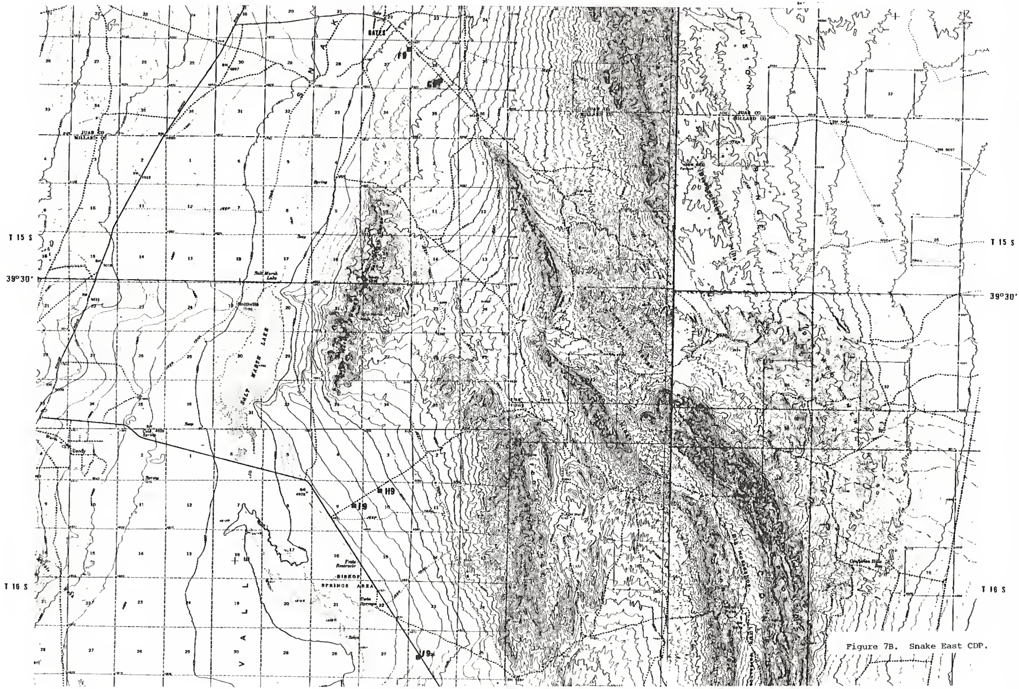
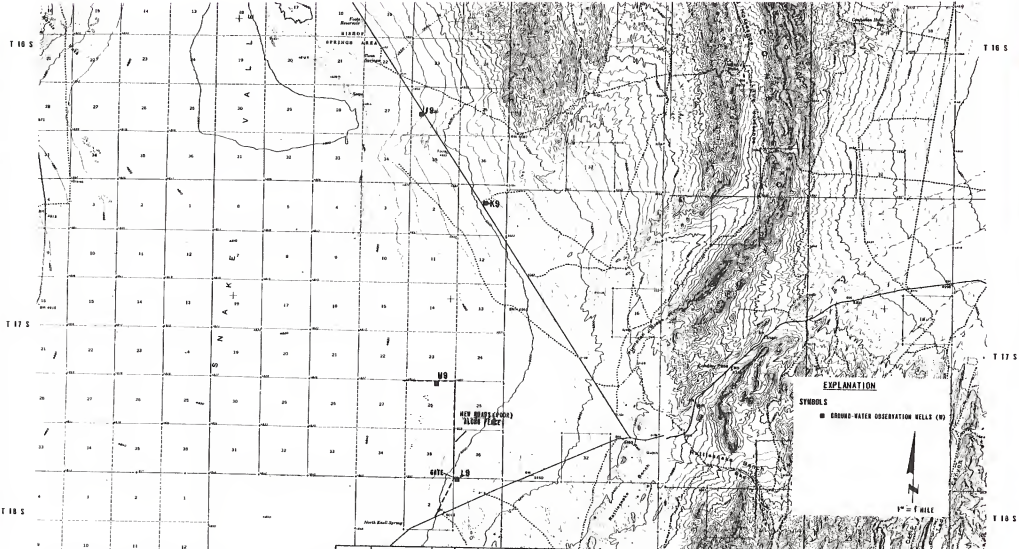


Figure 7B. Snake East CDP.



| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | — |
| CPTs | — |
| TRENCHES | — |
| TEST PITS | — |
| SR LINES | — |
| OBSERVATION WELLS | [illegible] |

Figure 7C. Snake East CDP.

| REV. | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | 3 JUL 79 | STAKED LOCATIONS OF FIELD ACTIVITIES | MLL |

SNAKE EAST (NORTH) CDP, UTAH

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ATTACHMENT 6

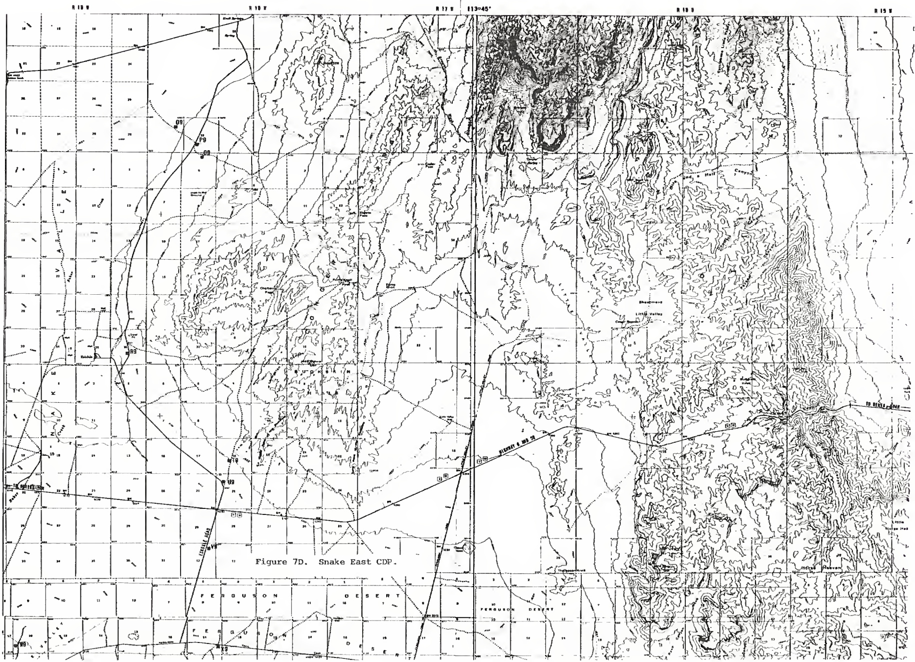


Figure 7D. Snake East CDP.

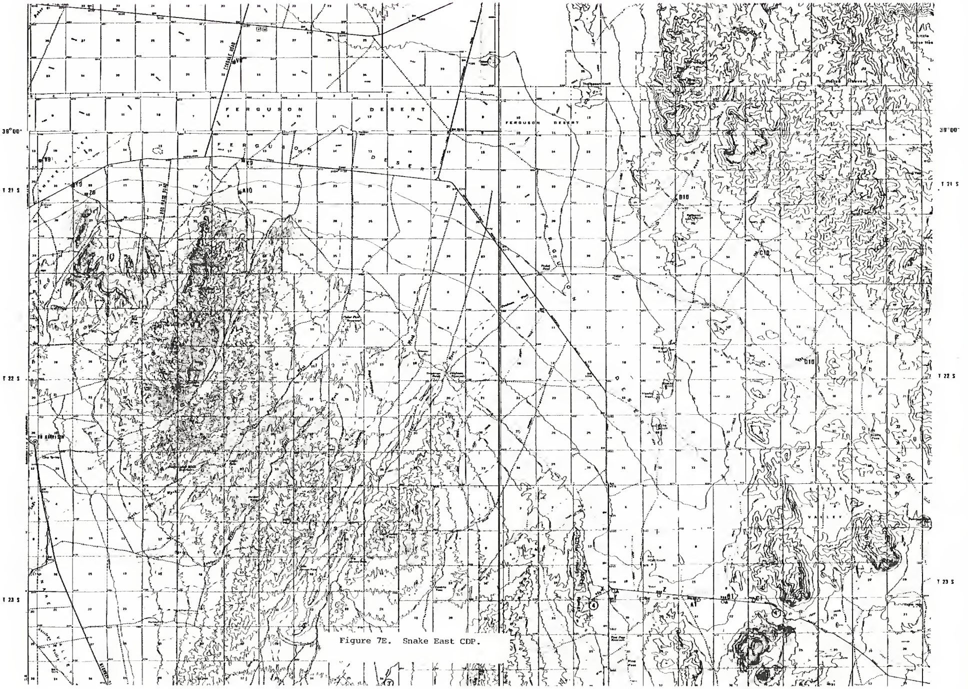
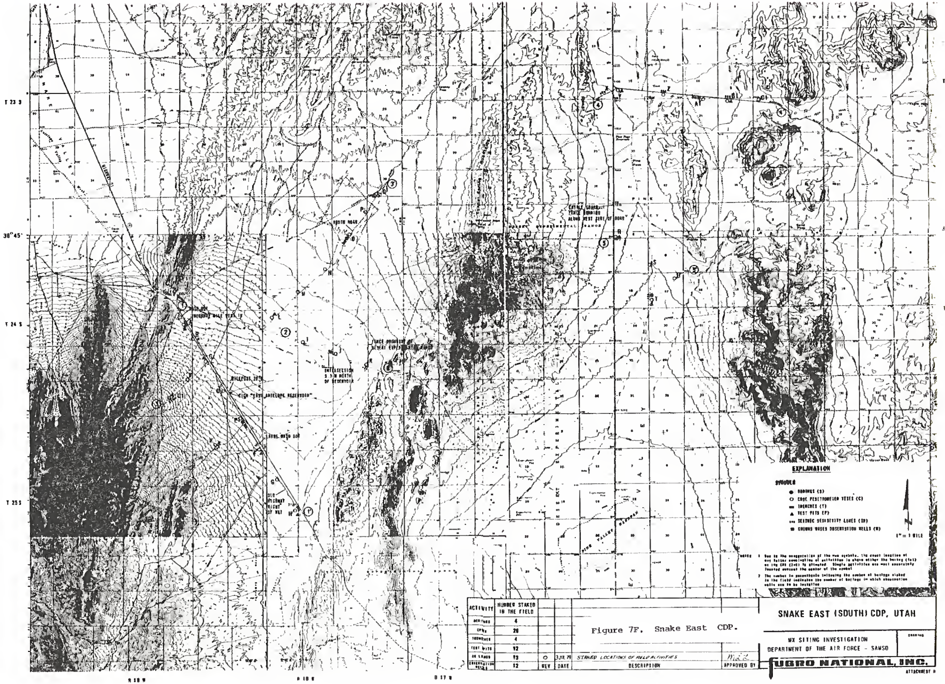


Figure 7E. Snake East CDP.


T 23 S
T 24 S
T 25 S
38°45'
R 18 W
R 17 W
SNAKE VALLEY
HIGHWAY 21
PINE VALLEY
DESERT EXPERIMENTAL RANGE
CATTLE GUARD FENCE BOUNDARY ALONG WEST SIDE OF ROAD
NORTH ROAD
FENCE BOUNDARY OF DESERT EXPERIMENTAL RANGE
INTERSECTION 3.3 M NORTH OF RESERVOIR
MILEPOST 20
HIGH "EAST ANTELOPE RESERVOIR"
OLD HIGHWAY RIGHT OF WAY
PINE VALLEY WASH
1" = 1 MILE

EXPLANATION

SYMBOLS

- ● BORINGS (B)
- ○ CONE PENETROMETER TESTS (C)
- ▬ TRENCHES (T)
- ▲ TEST PITS (P)
- ••• SEISMIC RESISTIVITY LINES (SR)
- ■ GROUND WATER OBSERVATION WELLS (W)

NOTES 1 Due to the exaggeration of the map symbols, the exact location of any letter combination of activities is where either the boring (1st) or the CPT (2nd) is situated. Single activities are most accurately located at the center of the symbol.

2 The number in parenthesis following the number of borings staked in the field indicates the number of borings in which observation wells are to be installed.

| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | 4 |
| CPT's | 20 |
| TRENCHES | 4 |
| TEST PITS | 12 |
| SR LINES | 13 |
| OBSERVATION WELLS | 12 |

Figure 7F. Snake East CDP.

| REV | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | 3 JUL 79 | STAKED LOCATIONS OF FIELD ACTIVITIES | |

SNAKE EAST (SOUTH) CDP, UTAH

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ATTACHMENT B

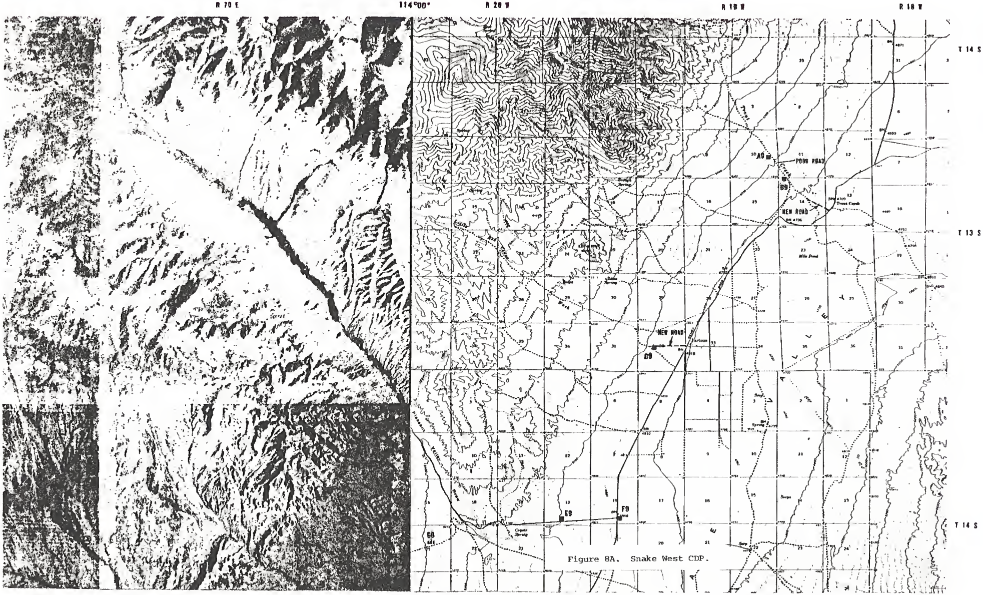


Figure 8A. Snake West CDP.

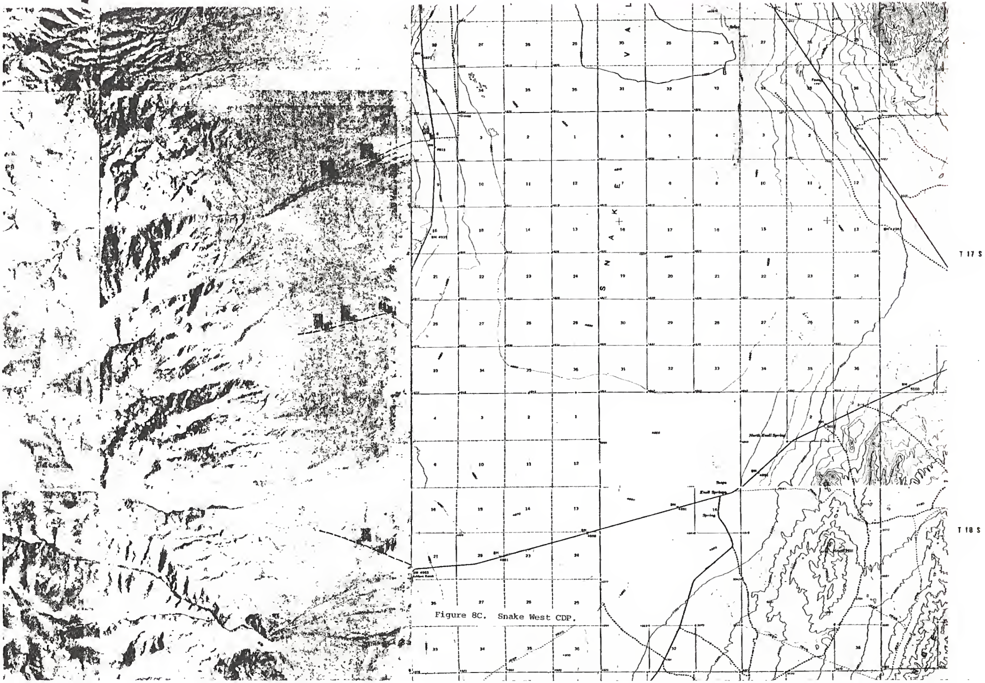
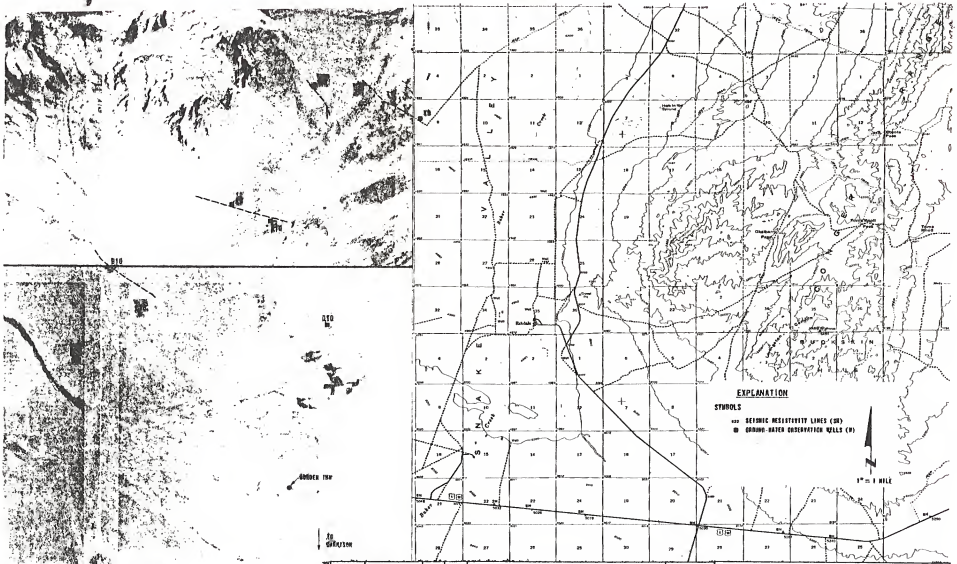


Figure 8C. Snake West CDP.



| ACTIVITY | NUMBER STAKED IN THE FIELD |
|---|---|
| BORINGS | — |
| CPT2 | — |
| TRENCHES | — |
| TEST PITS | — |
| SR LINES | 3 |
| OBSERVATION WELLS | 27 |

Figure 8D. Snake West CDP.

| REV. | DATE | DESCRIPTION | APPROVED BY |
|---|---|---|---|
| 0 | 3 JUL 79 | STAKED LOCATIONS OF FIELD ACTIVITIES | MLL |

SNAKE WEST CDP, UTAH

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DRAWING

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ATTACHMENT I